

XII

THE
TUTOR'S ASSISTANT;
 BEING $\frac{529. c. 21.}{2}$
 A COMPENDIUM of ARITHMETIC,
 AND
 A COMPLETE QUESTION-BOOK.

*The RULES are VERSIFIED; a PLAN entirely NEW,
 and much better adapted to young Minds than that of
 PROSE.*

CONTAINING,

- | | |
|---|--|
| <p>I. <i>Arithmetic</i> in Whole Numbers.</p> <p>II. <i>Vulgar Fractions.</i></p> <p>III. <i>Decimals</i>, with the <i>Extraction</i> of <i>Roots</i>, Rules for calculating <i>Interest</i>, <i>Annuities</i>, <i>Pensions</i> in <i>Arrears</i>, the <i>present Worth</i> of <i>Annuities</i>, &c. either by <i>Simple</i> or <i>Compound Interest</i>.</p> | <p>IV. <i>Duodecimals</i>, applied to measuring, with proper Examples.</p> <p>V. A Collection of <i>promiscuous Questions</i>.</p> <p>VI. A <i>general Table</i> for calculating <i>Interest</i> at any <i>Rate per Cent.</i> <i>Rents</i>, <i>Salary</i>, &c.</p> |
|---|--|

By FRANCIS WALKINGAME,
 WRITING-MASTER AND ACCOMPTANT.
 Author of *The Tutor's Assistant*, *Arithmetical Tables*, &c.

PRINTED for the AUTHOR;
 And Sold by J. SCATCHERD, and I. WHITAKER, Successors
 to E. JOHNSON, Ave-Mary-Lane, 1781.

THE
BEST TUTOR & ASSISTANT

TEACHING

A COMPREHENSIVE & ARITHMETIC

AND

A COMPLETE QUESTION BOOK

FOR THE USE OF PUPILS IN SCHOOLS AND COLLEGES
AND FOR THE REVUE OF THE TEACHERS

BY
J. W. WALLINGFORD

Author of the "First Principles of Algebra" and "The Elements of Algebra"
and of the "First Principles of Geometry" and "The Elements of Geometry"

BY FRANCIS WALLINGFORD
WRITING MASTER AND ACCOUNTANT
Author of the "First Principles of Arithmetic" and "The Elements of Arithmetic"

Printed by J. W. Wallingford, at the Press of the
J. W. Wallingford, at the Press of the

P R E F A C E.

SOME apology for the following Treatise will necessarily be expected by the Public.

The only apology the Author has to offer, is the very favorable reception of his former Work; which, from its first appearance to the present time, has passed through no less than 17 editions; is still honoured by a general acceptance in the principal ACADEMIES and SCHOOLS, and by the most approved private Teachers of Arithmetic in *Great Britain*. The sale has been rapid, the demand increasing, and the Author

vi P R E F A C E.

has had the satisfaction of finding it, in the fullest sense, *The TUTOR'S ASSISTANT*.

Happy in the success of his Work, he has ever been studious to make his grateful acknowledgments.

Instead, therefore, of presenting his Purchasers, this year, with *only*, or *merely*, a NEW EDITION, he has laboured to put into their hands a NEW TUTOR'S ASSISTANT.

The PLAN, as it has been universally approved, has undergone no alteration; the RULES, having been found so serviceable, continue the same, with the addition only of being turned into *Metre*; a mode, which, as by it the memory more easily and longer retains instruction, has ever had the preference over *Prose* adjudged to it. The EXAMPLES and QUESTIONS, by the variation of the Numbers, are transposed into so many new Exercises, for the ingenuity

P R E F A C E. vii

ingenuity of the Scholar to practise the several Rules.

The fineness of the Paper, the excellency of the Type, and the neatness of the Binding, will, it is hoped, be a sufficient plea for the small advance of the price.

To prevent giving the least disappointment to those Gentlemen, Schoolmasters, and others, who may prefer the former Work, a new edition thereof is just printed and published.

Though the most assiduous attention has been given to correct the Press, yet it is possible some trivial errors may have escaped notice. Should such be perceived, and transmitted to the Author, they will be thankfully received, and carefully attended to.

Great Russell-Street,
Bloomsbury,
January, 1781.

F. W.

CONTENTS.

PART I.

ARITHMETIC in WHOLE NUMBERS.

	Page		Page
INTRODUCTION	1	<i>Purchasing of Stocks</i>	57
<i>Numeration</i>	ib.	<i>Brokage</i>	58
<i>Integers, Addition</i>	3	<i>Compound Interest</i>	63
<i>Subtraction</i>	4	<i>Rebate or Discount</i>	64
<i>Multiplication</i>	5	<i>Equation of Payments</i>	66
<i>Division</i>	7	<i>Barter</i>	67
<i>Tables</i>	11	<i>Profit and Loss</i>	68
<i>Addition of several De-</i>	16	<i>Fellowship</i>	70
<i>nominations</i>		<i>with Time</i>	71
<i>Subtraction</i>	21	<i>Alligation Medial</i>	73
<i>Multiplication</i>	23	<i>Alternate</i>	75
<i>Division</i>	26	<i>Position, or Rule of False</i>	79
<i>Bills of Parcels</i>	28	<i>Double</i>	80
<i>Reduction</i>	31	<i>Exchange</i>	82
<i>Single Rule of Three Direct</i>	42	<i>Comparison of Weights</i>	86
<i>Inverse</i>	45	<i>and Measures</i>	
<i>Double Rule of Three</i>	47	<i>Conjoin'd Proportion</i>	ib.
<i>Practise</i>	49	<i>Progression Arithmetical</i>	88
<i>Simple Interest</i>	56	<i>Geometrical</i>	90
<i>Commission</i>	57	<i>Permutation</i>	94

CONTENTS

PART II.

VULGAR FRACTIONS.

	Page		Page
Reduction - - - -	96	Division - - - -	104
Addition - - - -	102	The Rule of Three Direct - - -	105
Subtraction - - - -	ib.	Inverse - - -	106
Multiplication - - -	103	The Double Rule of Three. - - -	ib.

PART III.

DECIMALS.

	Page		Page
Numeration - - - -	107	A general Rule for extracting the Roots of all Powers } - - -	127
Addition - - - -	108	Simple Interest - - - -	129
Subtraction - - - -	109	for Days - - -	130
Multiplication - - -	ib.	Annuities and Pensions, &c. in Arrears } - - -	133
Contracted Multiplication - - -	ib.	Present Worth of Annuities - - -	136
Division - - - -	110	Annuities, &c. in Reversion - - -	139
Contracted - - - -	111	Rebate or Discount - - - -	141
Reduction - - - -	112	Equation of Payments - - - -	143
Decimal Tables of Coin, } - - -	115	Compound Interest - - - -	144
Weights and Measures } - - -	118	Annuities, &c. in Arrears - - -	146
The Rule of Three - - -	118	Present Worth of Annuities - - -	149
Extraction of the Square Root - - -	119	Annuities, &c. in Reversion - - -	151
Vulgar Fractions - - -	120	Purchasing Freehold or Real Estates } - - -	152
Mixed Numbers - - -	ib.	in Reversion - - - -	153
Extraction of the Cube Root - - -	123	Rebate or Discount - - - -	155
Vulgar Fractions - - -	125		
Mixed Numbers - - -	ib.		
Biquadrate Root - - -	127		

CONTENTS.

PART IV.

VULGAR FRACTIONS.

Page

104

105

106

107

108

PART IV.

DUODECIMALS.

Page	Page
<i>Multiplication of Feet and Inches</i> } 157	<i>Measuring by the Square of 100 Feet</i> } 160
<i>Measuring by the Feet Square</i> } 159	<i>Measuring by the Rod</i> - 161
<i>Measuring by the Yard Square</i> } 161	<i>Multiplying Several Figures by several, and the Operation in one Line only.</i> } 162

PART V.

QUESTIONS.

Page	Page
<i>A Collection of Questions set down promiscuously, for the greater Trial of the foregoing Rules</i> } 163	<i>A general Table for calculating Interests, Rents, Incomes, and Servants Wages.</i> } 173

Explanation of the Characters made use of in this COMPENDIUM.

= Equal. The Sign of Equality; as, 4 qrs. = 1 cwt. signifies, that 4 qrs. are equal to 1 cwt.

— Minus or less. The Sign of Subtraction; as, $9 - 5 = 4$, that is 9 lessened by 5 is equal to 4.

+ Plus or more. The Sign of Addition; as, $7 + 2 = 9$, that is, 7 added to 2 is equal to 9.

× Multiplied by. The Sign of Multiplication; as, $7 \times 8 = 56$ that is 7 multiplied by 8 is equal to 56.

÷ Divided by. The Sign of Division; as, $12 \div$ by 3 = 4, that is, 12 divided by 3 is equal to 4.

$\frac{4172}{375}$ Numbers placed like a Fraction do likewise denote Division; the upper Number being the Dividend, and the lower the Divisor.

: : So is. The Sign of proportion; as, $4 : 12 :: 8 : 24$, that is, as 4 is to 12 so is 8 to 24.

$10 - 3 + 5 = 12$ Shews that the Difference between 3 and 10 added to 5 is equal to 12.

$12 - 3 + 4 = 5$ Signifies, that the Sum of 3 and 4 taken from 12 is equal to 5.

√ Prefixed to any number, signifies the Square Root of that number is required.

√³ Signifies the Cube, or third Power.

√⁴ Denotes the Biquadrate, or the fourth Power, &c.

i. e. *id est*, that is.

THE

EXPLANATION OF THE CHARACTERS MADE USE OF IN THIS COMPENDIUM.

1. Equal. The sign of Equality; as, $4 \text{ grs.} = 1 \text{ cent.}$
 again, that 4 grs. are equal to 1 cent.

2. Addition. The sign of Addition; as, $9 + 2 = 11$
 that 9 is added to 2 is equal to 11.

3. Subtraction. The sign of Subtraction; as, $7 - 2 = 5$, that
 2 is subtracted from 7 is equal to 5.

4. Multiplication. The sign of Multiplication; as, $7 \times 8 = 56$
 that 7 is multiplied by 8 is equal to 56.

5. Division. The sign of Division; as, $12 \div 3 = 4$, that
 12 is divided by 3 is equal to 4.

6. Fraction. The sign of Fraction; as, $\frac{1}{2}$, that
 1 is divided into 2 parts, each part is the 2^d part of the whole.

7. Proportion. The sign of proportion; as, $4 : 12 :: 8 : 24$
 that 4 is to 12 as 8 is to 24.

8. Difference. The sign of Difference; as, $10 - 7 + 2 = 5$
 shows that the difference between 10 and 7 is added to 2 is equal to 5.

9. Sum. The sign of Sum; as, $10 + 7 + 2 = 19$
 shows that the sum of 10, 7, and 2 is equal to 19.

10. Power. The sign of Power; as, 2^3 , that
 2 is raised to the 3^d power is equal to 8.

11. Root. The sign of Root; as, $\sqrt{4}$, that
 the square root of 4 is equal to 2.

12. Logarithm. The sign of Logarithm; as, $\log 100$, that
 the logarithm of 100 is equal to 2.

13. Tangent. The sign of Tangent; as, $\tan 45^\circ$, that
 the tangent of 45 degrees is equal to 1.

14. Sine. The sign of Sine; as, $\sin 90^\circ$, that
 the sine of 90 degrees is equal to 1.

15. Cosine. The sign of Cosine; as, $\cos 90^\circ$, that
 the cosine of 90 degrees is equal to 0.

16. Secant. The sign of Secant; as, $\sec 45^\circ$, that
 the secant of 45 degrees is equal to $\sqrt{2}$.

W R I T I N G,

IN ALL THE VARIOUS HANDS NOW IN USE:

A R I T H M E T I C,

THROUGH ALL ITS DIFFERENT RULES:

VULGAR and DECIMAL FRACTIONS,

WITH THE

Extraction of the Square and Cube Root:

ALSO

D U O D E C I M A L S:

ARE TAUGHT ABROAD, BY

F. W A L K I N G A M E,

Great Russel-Street, BLOOMSBURY:

Where may be had, *The Tutor's Assistant, ARITHMETICAL and INTEREST TABLES, &c.*

W R I T I N G

IN ALL THE VARIOUS HANDS NOW IN USE

A R T H U R I C

THROUGH ALL ITS DIFFERENT PHASES

ALGEBRA AND LINEAL FRACTIONS

WITH THE

EXPLANATION OF THE SQUARE AND CUBE ROOTS

ALSO

D U O D E C I M A L S

ARE TAUGHT ABROAD BY

F W A L K I N G M A N

OF THE ROYAL SCHOOL, BLOOMSBURY

WHICH MAY BE HAD OF THE AUTHOR'S ASSISTANT, MESSRS. HARRIS, 11, PATERNOSTER ROW, LONDON, E.C. 4.

(1)

THE
NEW TUTOR'S ASSISTANT;
BEING
A COMPENDIUM OF ARITHMETIC.

PART I.

Arithmetic in Whole Numbers.

THE INTRODUCTION.

ARITHMETIC is the Art or Science of computing by Numbers, and consists in *Theory* and *Practice*.

The **THEORY** considers the Nature and Quality of Numbers and demonstrates the Reason of practical Operations.

The **PRACTICE** is that which shews the Method of working by Numbers, so as to be the most useful and expeditious for Business, and has five principal or fundamental Rules for the Operations, *viz.*

NOTATION OF NUMERATION, ADDITION, SUBTRACTION, MULTIPLICATION, and DIVISION.

NUMERATION

TEACHETH the different Value of Figures by their different Places, and to read or write any Sum or Number.

The TABLE.

C Millions. X Millions. Millions.			C Thousands. X Thousands. Thousands.			Hundreds. Tens. Units.		
9	8	7	6	5	4	3	2	1
	9	8	7	6	5	4	3	2
		9	8	7	6	5	4	3
			9	8	7	6	5	4
				9	8	7	6	5
					9	8	7	6
						9	8	7
							9	8
								9

RULE. Begin each period at the right-hand,
Where *units* first, next *tens*, next *hundreds* stand.
And then to give the proper value due
To the three periods you distinctly view
Call the left *millions*, *thousands* next you see,
And then the last will *simple units* be.

The APPLICATION.

Twenty-five.
Three Hundred forty-six.
Two Thousand, five Hundred and seven.
Thirty-seven Thousand, five Hundred eighty-three.
Two Hundred, twenty-five Thousand, three Hundred and four.
Three Millions, five Hundred fifty-four Thousand, two Hundred and sixteen.
Sixty-four Millions, seven Hundred thirty-two Thousand, two Hundred and ten.
Eight Hundred thirty-five Thousand, six Hundred seventy-seven.
Three hundred twenty-four Millions, two Hundred five Thousand, three Hundred and twenty-nine.

Write

ASSISTANT.

Addition. 3

Write down in words at length the following Numbers.

27	4518	270042	3271025	71205973
39	3700	321520	2093176	257002715
207	45109	950270	75109257	712930050

Notation by ROMAN Letters.

I One	XXX Thirty
II Two	XL Forty
III Three	L Fifty
IV Four	LX Sixty
V Five	LXX Seventy
VI Six	LXXX Eighty
VII Seven	XC Ninety
VIII Eight	C Hundred
IX Nine	CC Two Hundred
X Ten	CCC Three Hundred
XI Eleven	CCCC Four Hundred
XII Twelve	D Five Hundred
XIII Thirteen	DC Six Hundred
XIV Fourteen	DCC Seven Hundred
XV Fifteen	DCCC Eight Hundred
XVI Sixteen	DECCC Nine Hundred
XVII Seventeen	M Thousand
XVIII Eighteen	MDCCLXXXI One Thou-
XIX Nineteen	sand, Seven Hundred and
XX Twenty	Eighty One.

I N T E G E R S.

A D D I T I O N

TEACHETH to add two or more sums together, to make one whole or total sum.

RULE. To add up several numbers you must place
Tens under *tens*, *units* in *units* space,
 Which being done, add up the right hand row
 And of that sum, the *units* place below,
 The *tens* with the next column you must count,
 But at the last express the *whole* amount.

Proof. Begin at top and downwards reckon on,
 And if the sum's the same, 'tis rightly done.

ADDITION and SUBTRACTION TABLE.

1	2	3	4	5	6	7	8	9
2	4	5	6	7	8	9	10	11
3	5	6	7	8	9	10	11	12
4	6	7	8	9	10	11	12	13
5	7	8	9	10	11	12	13	14
6	8	9	10	11	12	13	14	15
7	9	10	11	12	13	14	15	16
8	10	11	12	13	14	15	16	17
9	11	12	13	14	15	16	17	18

<i>Qrs.</i>	<i>lbs.</i>	<i>cwt.</i>	<i>Months.</i>	<i>£.</i>	<i>Years.</i>
3	27	274	3710	7102	27104
2	35	529	2593	3710	71926
7	92	371	7162	2574	32715
9	26	524	1948	9215	51298
3	38	719	3271	2571	20471
7	54	635	2519	9125	71025
6	71	712	7193	2716	27109
2	29	296	2712	3271	71025
9	32	317	7025	9135	27104
50	404				

S U B T R A C T I O N

TEACHETH to take a less Number from a greater, and shews the remainder, or difference.

RULE. From the first place in *upper row*
Take what is *under*; place *below*,
What's over; if it can't be done
Then borrow *ten*, and carry *one*.

Proof. Add the *remainder* and *less line* in one,
If like the *greater*, it is rightly done.

<i>Hund.</i>	<i>£.</i>	<i>Hours.</i>	<i>Cwt.</i>	<i>Hgds.</i>	<i>Minutes.</i>
723	42710	87104	70357	632714	927531
271	27509	71046	631931	519275	712197
Rem. 454					
Proof. 725					

M U L T I P L I C A T I O N

TEACHETH to encrease the greater of two numbers given, as often as there are units in the less; and compendiously performs the office of many Additions.

To this Rule belong three principal members, *viz.*

1. The Multiplicand, or number to be multiplied.
2. The Multiplier, or number by which you multiply.
3. The Product, or number produced by multiplying.

RULE. Take the first figure in the upper row
And multiply it by the first below,
Set down the units, keep the *tens* in store
Till by the multiplier us'd before,
You've multiplied another figure more,
The *tens* you have to the last product join,
And so proceed throughout the upper line.

Proof. Divide the *product* by *multiplicand*,
The *quotient* will like *multiplier* stand.

MULTIPLICATION and DIVISION TABLE.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

Multiplicand	7193742	51927045	671025741
Multiplier	2	3	4
Product	14387484		

6 Multiplication.

The New Tutor's

725309 5	310257 6	63057109 7	72104357 8
371045 9	2710925 11	52093751 12	29371025 12

2. When the multiplier is more than 12, and less than 20.

RULE. When e'er your multiplier's more
Than twelve, and yet beneath a score,
The units place a multiplier make,
In the product the back figure take.

7219357 13	2519274 14	9270415 15	62719205 16
632019 17	7631529 18	2571925 19	37102595 19

3. When the multiplier consists of several Figures.

RULE. If many places you should see
In multiplier, there must be
As many products, in which case
The units of each product place
Beneath the multiplier; mind
To add the whole; the toté you'll find.

710257 26	2710247 37	9205743 269	2192751 475
4261542 1420514 18466682	100279139	2476344867	1041556725

4. When Cyphers are placed between the significant figures in the multiplier.

RULE. If among figures noughts appear
You may omit them, but 'tis clear
The product of the next must stand,
A figure more to the left hand.

ASSISTANT.

Division: 7

7210409
65007

32709251
370204

670259074
790026

5. When there are Cyphers at the end of the Multiplicand and Multiplier.

RULE. Omit the cyphers found at the right-hand
Of multiplier, or multiplicand,
But to the total product then restore
As many noughts as you left out before.

721500
25700

2974000
76000

637000
39000

294050
7500

6. When the Multiplier is a composite Number.

RULE. If e'er two figures multiplied will make
The multiplier, one of those figures take,
And with it multiply, that product too
By t'other figure will the answer shew.

2719254 by 36

37259048 by 56

4710459 by 64

D I V I S I O N

TEACHETH to find how often one number is contained in another; or to divide any number into what parts you please.

In this Rule there are three Numbers real, and a fourth accidental; *viz.*

1. The *Dividend*, or Number to be divided;
2. The *Divisor*, or Number by which you divide;
3. The *Quotient*, or Number that shews how often the Divisor is contained in the Dividend.
4. An accidental number, is what remain, when the work is finished, and is of the same name as dividend.

RULE. If the divisor less than twelve should be
How oft 'tis found in the first figure see,
Set down that quote, and carry what remains
To the next in the dividend as tens;
Then find how oft that number doth contain
The first divisor and set down again
The quote: and so go on 'till none remain.

When

8 Division.

The New Tutor's

When e'er the sum by which you must divide
Be more than twelve, let it be multiplied
By quotient figure, and the product be
Subtracted from the dividend; then see
What's over, to which you must bring down
The figure next, and in that mode go on.

Dividend Rem.

Divisor	2)712597(1	3)710425(	4)6127524(
Quotient	356298		
	2		
Proof	712597	5)321074	6)3271035
	7)3210425(	8)2519275(	9)63215924
	11)410257(	11)6302597(	12)32710425(

Divisor Dividend Quotient

37)32104259(867682
296 37

250 6073774
222 2603046

25 Rem.

284 32104259 Proof

252
222

305
296

99
74

25 Rem.

25)632142(

27)672594(

321)2519274(

4192)610259735(

2519)81275104(

63214)71043219(

320149)8710259971(

271042)710259371(

710425)321597192(

3210471)9210471057(

6300571)6510271925(

9210475)8127192574(

2. When there are Cyphers at the end of the Divisor.

RULE. Cut off what noughts are at divisor's end,
As many places too from dividend,
But to the last remainder, mind, restore
What e'er you took from dividend before.

Proof. Quote and Divisor multiply'd must be;
Add what remains, and then if right you'll see
The product and dividend will agree.

371|00)571254|36(
456|000)7102597|104(

2751|00)37102597|41(
6275|000)4127048|925(

3. When the Divisor is a composite Number.

RULE. If the divisor should perchance to be
A number composite, then you may see
What numbers multiply'd will just it make;
The first of them for a divisor take;
That quotient by the other, then divide
The latter quote the answer will provide.

Div. 721542 by 23 7327104 By 36 4193782 by 64 92104737 by 72

Quot. _____

It sometimes happens there are two remainders, then

Multiply last rem. with first divisor, which done
Added to the first remainder gives the true one.

M O N E Y.

Marked

$\frac{1}{4}$ Farthing.
 $\frac{1}{2}$ Halfpenny.
 $\frac{3}{4}$ Three Farthings.
Farthings.

4 Farthings make 1 Penny.
12 Pence - - - 1 Shilling.
20 Shillings - - 1 Pound.

Marked

4 = 1 Penny.
48 = 12 = 1 Shilling.
960 = 240 = 20 = 1 Pound.

SHILLINGS.

PENCE TABLE.

s.	l.	s.	d.	s.	d.	s.	d.	
20	-	1 : 0	12	-	1 : 0	84	-	7 : 0
30	-	1 : 10	18	-	1 : 6	90	-	7 : 6
40	-	2 : 0	20	-	1 : 8	96	-	8 : 0
50	-	2 : 10	24	-	2 : 0	100	-	8 : 4
60	is	3 : 0	30	-	2 : 6	108	-	9 : 0
70	-	3 : 10	36	-	3 : 0	110	-	9 : 2
80	-	4 : 0	40	is	3 : 4	120	is	10 : 0
90	-	4 : 10	48	-	4 : 0	130	-	10 : 10
100	-	5 : 0	50	-	4 : 2	132	-	11 : 0
110	-	5 : 10	60	-	5 : 0	140	-	11 : 8
120	-	6 : 0	70	-	5 : 10	144	-	12 : 0
130	-	6 : 10	72	-	6 : 0	150	-	12 : 6
			80	-	6 : 8			

TROY WEIGHT.

24 Grains - - -	make - -	1 Pennyweight.	} <i>Marked</i> <i>grs.</i> <i>dwt.s.</i>
20 Pennyweights - - -	- - -	1 Ounce.	
12 Ounces - - -	- - -	1 Pound.	

Grains.

24 = 1 Pennyweight.

480 = 20 = 1 Ounce.

5760 = 240 = 12 = 1 Pound.

By this Weight are weighed Gold, Silver, Jewels, Electuaries, and all Liquors.

N. B. The Standard for gold Coin is 22 *Carats* of fine Gold, and 2 *Carats* of Copper melted together. For Silver is 11 *oz.* 2 *dwt.s.* of fine Silver, and 18 *dwt.s.* of Copper.

25 lb. is a Quarter of an *cwt.* 100 lb. 1 *cwt.*

20 *cwt.* 1 *Ton* of Gold or Silver.

A VOIR DUPOISE WEIGHT.

16 Drains - - -	make - - -	1 Ounce.	} <i>Marked</i> <i>drs.</i> <i>oz.</i>
16 Ounces - - -	- - -	1 Pound.	
28 Pounds - - -	- - -	1 Quarter.	
4 Quarters or 112 lb.	-	1 Hundred Weight.	<i>cwt.</i>
20 Hundred Weight - - -	- - -	1 Ton.	<i>Ton.</i>

Drams.

16 = 1 Ounce.

256 = 16 = 1 Pound.

7168 = 448 = 28 = 1 Quarter.

28672 = 1792 = 112 = 4 = 1 Hund. Weight.

573440 = 35840 = 2240 = 80 = 20 = 1 Ton.

There are several other denominations in this Weight, which are used in some particular Goods, *viz.*

A Firkin of Butter - -	56	A Stone of iron Shot, } <i>lb.</i>	
Soap - -	94	or Horseman's wt. }	14
A Barrel of Anchovies -	30	Butcher's Meat -	8
Soap - -	256	A Gallon of Train Oil -	7½
Raisins - -	112	A Truss of Straw - -	36
A Pancheon of Prunes	1120	New Hay -	60
A Fother of Lead, 19 <i>cwt.</i>		Old Hay -	56
2 <i>grs.</i>		36 Trusses a Load.	

Cheese and Butter.

A Clove or half Stone, 8lb.

A Wey in Suffolk, }	lb.	A Wey in Essex, }	lb.
32 Cloves, or }	- - 256	42 Cloves, or }	- - 336

Wool.

	lb.	A Wey is 6 Tod and 2	lb.
A Clove - - - - -	7	1 Stone, or - - -	182
A Stone - - - - -	14	A Sack is two Weys, or	364
A Tod - - - - -	28	A Last is 12 Sacks, or	4368

By this Weight is weighed any thing of a coarse or drossy nature; as all Grocery and Chandlery Wares; Bread and all Metals but Silver and Gold.

Note, 1 Pound Avoirdupoise is equal to 14 oz. 11 dwts. 15 grs. $\frac{1}{2}$ Troy.

APOTHECARY'S WEIGHT.

20 Grains - - - - -	make - - -	1 Scruple. - - -	Marked
3 Scruples - - - - -	- - - - -	1 Dram. - - -	9
8 Drams - - - - -	- - - - -	1 Ounce. - - -	3
12 Ounces - - - - -	- - - - -	1 Pound. - - -	16

Grains.

20 = 1 Scruple.

60 = 3 = 1 Dram.

480 = 24 = 8 = 1 Ounce.

5760 = 288 = 96 = 12 = 1 Pound.

Note, The Apothecaries mix their Medicines by this Rule, but buy and sell their Commodities by Avoirdupoise Weight.

The Apothecary's Pound and Ounce, and the Pound and Ounce Troy are the same, only differently divided and subdivided.

CLOTH MEASURE.

4 Nails - - - - -	make - - -	1 Quarter of a Yard. }	Marked
3 Quarters - - - - -	- - - - -	1 Flemish Ell. - - -	F. E.
4 Quarters - - - - -	- - - - -	1 Yard. - - -	Yd.
5 Quarters - - - - -	- - - - -	1 English Ell. - - -	E. E.
6 Quarters - - - - -	- - - - -	1 French Ell. - - -	Fr. E.
			Inches.

Inches.

$2\frac{1}{4}$	=	1 Nail.
9	=	4 = 1 Quarter.
36	=	16 = 4 = 1 Yard.
27	=	12 = 3 = 1 Flemish Ell.
45	=	20 = 5 = 1 English Ell.

LONG MEASURE.

					Marked
3 Barley-corns	-	make	1 Inch.	- - -	$\left\{ \begin{array}{l} \text{bar.} \\ \text{in.} \end{array} \right.$
12 Inches	- - -		1 Foot.	- - -	feet.
3 Feet	- - -		1 Yard.	- - -	yd.
6 Feet	- - -		1 Fathom.	- - -	fath.
5½ Yards	- - -		1 Rod, Pole or Perch.	- - -	Rod. p.
40 Poles	- - -		1 Furlong.	- - -	furlong.
8 Furlongs	- - -		1 Mile.	- - -	mile.
3 Miles	- - -		1 League	- - -	lea.
60 Miles	- - -		1 Degree	- - -	deg.

Barley Corns.

3	=	1 Inch.
36	=	12 = 1 Foot.
108	=	36 = 3 = 1 Yard.
594	=	198 = 16½ = 5½ = 1 Pole.
23760	=	7920 = 660 = 220 = 40 = 1 Furlong.
190080	=	63360 = 5280 = 1760 = 320 = 8 = 1 Mile.

N. B. A Degree is 69 Miles, 4 Furlongs nearly, though commonly reckoned but 60 Miles.

This Measure is used to measure Distance of Places, or any Thing else that has length only.

WINE MEASURE.

					Marked
2 Pints	- -	make	1 Quart.	- - -	$\left\{ \begin{array}{l} \text{qrt.} \\ \text{qt.} \end{array} \right.$
4 Quarts	- - -		1 Gallon.	- - -	gal.
10 Gallons	- - -		1 Anchor of Brandy.	- - -	anc.
18 Gallons	- - -		1 Runlet.	- - -	run.
31½ Gallons	- - -		Half an Hoghead.	- - -	½ hhd.
42 Gallons	- - -		1 Tierce.	- - -	tierce.
63 Gallons	- - -		1 Hoghead.	- - -	hhd.
2 Hogheads	- - -		1 Pipe or Butt.	- - -	butt.
2 Pipes, or 4 Hogheads	- - -		1 Tun.	- - -	tun.
					Inches.

Inches.

287 = 1 Pint.

$$57\frac{3}{4} = 2 = 1 \text{ Quart.}$$

231 = 8 = 4 = 1 Gallon.

$$9702 = 336 = 168 = 42 = 1 \text{ Tierce.}$$

$14553 = 504 = 252 = 63 = 1\frac{1}{2} = 1$ Hoghead.

$19104 = 672 = 336 = 84 = 2 = 1\frac{1}{3} = 1$ Ponceon.

$$29106 \div 1008 = 504 \div 126 = 3 = 2 = 1\frac{1}{2} = 1 \text{ Pipe.}$$
$$58212 = 2016 = 1008 = 252 = 6 = 4 = 3 = 2 = 1 \text{ Ton}$$

All brandies, spirits, perry, cyder, mead, vinegar, honey, and oil, are measured by this measure, as also milk; not by law, but custom only.

ALE and BEER MEASURE.

2 Pints - - make - - 1 Quart - - - } p13.

4 Quarts,	-	-	-	-	1 Gallon.	-	-
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8 Gallons, - - - - - 1 Firkin of Ale. - - 4. 1/2

9 Gallons, - - - - - 1 Firkin of Beer. - - B. fir

2 Firkins, - - - - - 3 Kilderkin. - - - kil.

4 Firkins, or 2 Kilderkins, 1 Barrel - - - - bar.

1 Barrel and $\frac{1}{2}$, or 54 Gall. 1 Hogshead of Beer. - *bhd.*

2 Barrels, - - - - - 1 Puncheon. - - - - - pun.

3 Barrels, or 2 Hogheads, 1 Butt. - - - - - butt.

Cubic Inches. B E E R.

35 = 1 Pint.

$$70\frac{1}{2} \div 2 = 1 \text{ Quart.}$$

82 = 8 = 4 = 1 Gallon.

$$253^8 = 72 = 36 = 9 = 1 \text{ Firkin.}$$

$5076 = 144 = 72 = 18 = 2 = 1$ Kilderkin.

$$10152 = 288 = 144 = 36 = 4 = 2 = 1 \text{ Barrel.}$$

$15228 = 432 = 216 = 54 = 6 = 3 = 1\frac{1}{2} = 1$ Hoghead.

$20304 = 576 = 288 = 72 = 8 = 4 = 2 = 1$ Punccheon.

$$30456 = 864 = 432 = 108 = 12 = 6 = 3 = 2 = 1 \text{ Butt.}$$

Cubic Inches.	A	L	E
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2			
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100			

 $35\frac{1}{4} = 1 \text{ Pint.}$
$$70\frac{1}{2} = 2 = 1 \text{ Quart.}$$

$82 = 8 = 4 = 1$ Gallon.

$$2256 = 64 = 32 = 8 = 1 \text{ Firkin.}$$
$$4512 = 128 = 64 = 16 = 2 = 1 \text{ Kilderkin.}$$
$$9024 = 256 = 128 = 32 = 4 = 2 = 1 \text{ Barrel.}$$
$$13536 \div 384 = 192 = 48 = 6 = 3 = 1\frac{1}{2} = 1 \text{ Hhd.}$$

C

In

In *London* they compute but 6 gallons to the firkin of ale, and 32 to the barrel; but in all other parts of *England*, for ale, strong beer, and small, 34 gallons to the barrel, and 8 gallons and $\frac{1}{2}$ to the firkin.

N. B. A barrel of salmon or eels, is - 42 gallons.
 A barrel of herrings, - - - 32 gallons.
 A keg of sturgeon, - - - 4 or 5 gallons.
 A firkin of soap, - - - 8 gallons.

DRY MEASURE.

						Marked
2 Pints,	-	make	-	-	1 Quart.	$\left\{ \begin{array}{l} pts. \\ qts. \end{array} \right.$
2 Quarts,	-	-	-	-	1 Pottle.	pot.
2 Pottles,	-	-	-	-	1 Gallon.	gal.
2 Gallons,	-	-	-	-	1 Peck.	pk.
4 Pecks,	-	-	-	-	1 Bushel.	bu.
2 Bushels,	-	-	-	-	1 Strike.	strike.
4 Bushels,	-	-	-	-	1 Coom.	coom.
2 Cooms, or 8 Bushels,	-	-	-	-	1 Quarter.	qr.
4 Quarters,	-	-	-	-	1 Chaldron.	chal.
5 Quarters,	-	-	-	-	1 Wey.	wey.
2 Weys,	-	-	-	-	1 Last.	last.

Solid Inches.

$268\frac{2}{3} = 1$ Gallon.
 $537\frac{1}{3} = 2 = 1$ Peck.
 $2150\frac{2}{3} = 8 = 4 = 1$ Bushel.
 $4300\frac{1}{3} = 16 = 8 = 2 = 1$ Strike.
 $8601\frac{2}{3} = 32 = 16 = 4 = 2 = 1$ Coom.
 $17203\frac{1}{3} = 64 = 32 = 8 = 4 = 2 = 1$ Quarter.
 $86106 = 320 = 160 = 40 = 20 = 10 = 5 = 1$ Wey.
 $172032 = 640 = 320 = 80 = 40 = 20 = 10 = 2 = 1$ Last.

The Bushel in *Water Measure* is 5 Pecks.

In *London* 36 Bushels make a Chaldron.

A score of Coals is - 21 Chaldrons.

A sack of Coals - - - 3 Bushels.

A chaldron of Coals - - - 3 Sacks.

A load of Corn - - - 3 Bushels.

A cart load ditto - - - 40 Bushels.

This measure is applied to all dry goods.

The standard bushel is 18 inches and $\frac{1}{2}$ wide, and 8 inches deep.

SQUARE

S Q U A R E M E A S U R E .

144 Inches	- - make	- - -	1 Foot.	=
9 Feet	- - -	- - -	1 Yard.	=
100 Feet	- - -	- - -	1 Square of flooring.	=
272½ Feet	- - -	- - -	1 Rod.	=
40 Rods	- - -	- - -	1 Rood.	=
4 Roods, or 160 rods, or 4840 yards	- - -	- - -	1 Acre of land.	=
640 Acres	- - -	- - -	1 Square mile.	=
30 Acres	- - -	- - -	1 Yard of Land.	=
100 Acres	- - -	- - -	1 Hide of Land.	=

Inches.

$$144 = 1 \text{ Foot.}$$

$$1296 = 9 = 1 \text{ Yard.}$$

$$39204 = 272\frac{1}{2} = 30\frac{1}{2} = 1 \text{ Pole.}$$

$$568160 = 10890 = 1210 = 40 = 1 \text{ Rood.}$$

$$6272640 = 43560 = 4840 = 160 = 1 \text{ Acre.}$$

By this Measure are measured all things that have length and breadth; such as land, painting, plaistering, flooring, thatching, plumbing, glazing, &c.

S O L I D M E A S U R E .

$$1728 \text{ Inches} - \text{make} - 1 \text{ solid foot.}$$

$$27 \text{ Feet} - - - - - 1 \text{ Yard or load of earth.}$$

$$\left. \begin{array}{l} 40 \text{ Feet of round timber} \\ \text{or } 50 \text{ Feet of hewn} \\ \text{timber} \end{array} \right\} \text{ is one ton, or load.}$$

108 solid feet, i. e. 12 feet in length, 3 feet in breadth, and 3 deep; or, commonly 14 feet long, 3 feet 1 inch broad, and 3 feet 1 inch deep, is a stack of wood.

128 solid feet, i. e. 8 feet long, 4 feet broad, and 4 feet deep is a cord of wood.

By this measure are measured all things that have length, breadth, and depth.

T I M E .

60 Seconds	- - make	- -	1 Minute	- -	Marked { " m. hour. day. week. mo. yr.
60 Minutes	- - -	- -	1 Hour	- -	
24 Hours	- - -	- -	1 Day	- -	
7 Days	- - -	- -	1 Week	- -	
4 Weeks	- - -	- -	1 Month	- -	mo. yr.
13 Months, 1 day, 6 hours	- - -	- -	1 Julian year	- -	

C 2

Seconds.

The New Tutor's

60 = 1 Minute.

3600 = 60 = 1 Hour.

$$86400 = 1440 = 24 = 1 \text{ Day.}$$
$$604800 \div 10080 \div 168 \div 7 = 1 \text{ Week.}$$

2419200 = 40120 = 672 = 28 = 4 = 1 Month.

$$31557600 = 525960 = 8766 = 365.6 = 2.16 = 1 \text{ Julian yr.}$$
$$31556937 = 525948 \times 765 = 305 \times 48.57 = 1 \text{ Solar yr.}$$

To know the Days in each Month, observe,

Thirty days hath September,

April, June, and November,

February bath twenty-eight alone,

All the *rest* have thirty and one ;

Except in *Leap* Year, and then's the Time,

February's Days are twenty-nine.

ADDITION of MONEY, WEIGHTS and MEASURES.

RULE. First add the Row that has the lowest Name,
Divide it by as many of the same
As make an unit of the next degree,
Set down what's o'er, and let the quotient be
To the next line convey'd, and then go on
Unto the last, which simply must be done.

PROOF. As in whole Numbers.

M O N E Y.

L.	s.	d.	L.	s.	d.	L.	s.	d.	L.	s.	d.
7	14	$0\frac{1}{2}$	9	7	$2\frac{1}{4}$	13	8	$8\frac{1}{2}$	35	19	$7\frac{1}{4}$
2	15	$2\frac{1}{4}$	8	16	$5\frac{1}{2}$	19	7	$7\frac{1}{4}$	25	14	$11\frac{1}{2}$
9	10	$3\frac{1}{2}$	3	15	$2\frac{1}{2}$	35	16	$2\frac{1}{4}$	93	15	$2\frac{1}{4}$
3	16	$11\frac{1}{4}$	7	12	$9\frac{1}{4}$	71	15	$7\frac{1}{2}$	71	9	$10\frac{1}{2}$
7	1	$9\frac{1}{2}$	6	3	$7\frac{1}{2}$	29	10		35	12	$7\frac{1}{4}$
2	18	$7\frac{1}{4}$	7	19	$2\frac{1}{4}$	35		$7\frac{1}{2}$	29	7	$1\frac{1}{2}$
9	2	$6\frac{1}{2}$	2	15	$7\frac{1}{4}$	27	9	$8\frac{1}{2}$	32	13	$8\frac{1}{4}$
42	19	$5\frac{1}{2}$									

ASSISTANT. *Addition of Money and Weights.* 17

£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
371	12	7½	710	15	2½	27	12	10¼	35	7	2½
259	4	5½	257	9	3½	35	17	3½	21	14	9½
695	17	6½	712	13	7½	71	13	8½	25	17	3½
274	12	10¼	357	19	2½	25	9	10¼	27	19	7½
719	15	1½	194	13	8½	92	15	7½	32	15	2½
925	7	11½	319	12	7½	25	7	10½	71	9	11½

£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
710	15	9½	270	14	11½	72	15	2½	25	9	7½
359	17	2½	719	8	5½	29	7	10½	21	2	9½
915	13	8½	257	19	2½	35	13	8½	25	17	10½
257	10	5½	716	15	8½	71	9	11½	71	6	11½
371	9	11½	275	18	10¼	25	10	2½	25	19	8½
259	13	2½	129	15	6½	79	16	10½	71	12	11½

TROY WEIGHT.

lbs.	oz.	dwt.	lbs.	oz.	dwt.	oz.	dwt.	gr.	oz.	dwt.	gr.
7	11	17	6	10	17	7	14	21	7	17	21
3	9	19	4	9	13	2	7	19	9	13	2
9	10	15	9	11	18	7	16	18	7	19	14
6	7	12	2	5	7	8	14	22	8	15	22
9	11	15	9	6	14	7	19	16	6	9	7
2	8	18	7	5	19	8	15	18	4	15	21

AVOIRDUPOISE WEIGHT.

Tons	cwt.	grs.	Cwt.	grs.	lbs.	lbs.	oz.	dr.	lbs.	oz.	dr.
72	19	3	27	3	27	71	15	14	27	14	11
27	2	1	19	2	21	35	7	9	19	2	6
63	14	2	37	1	19	29	3	15	65	13	8
79	15	1	74	2	18	72	14	12	74	2	9
34	17	2	35	1	19	25	7	14	25	7	13
19	10	1	71	2	24	71	2	15	71	9	12

APOTHECARY'S WEIGHT.

lb.	oz.	dr.	lb.	oz.	dr.	3	3	9	gr.	3	3	9	gr.
9	11	2	19	10	4	7	5	2	19	8	7	1	15
7	2	3	14	11	7	8	7	1	14	7	6	2	18
6	5	7	27	9	4	9	6	2	18	6	5	1	17
9	10	2	63	2	7	7	3	0	17	8	1	0	18
5	9	7	15	7	2	9	1	2	16	9	1	2	14
6	3	5	18	2	6	2	6	1	14	6	5	2	12

CLOTH MEASURE.

EL.	qrs.	Yds.	qrs.	n.	Yds.	qrs.	n.	EF.	qrs.	n.
79	.. 4 .. 2	35	.. 3 .. 3	75	.. 2 .. 3	75	.. 2 .. 1			
35	.. 3 .. 3	64	.. 2 .. 2	38	.. 1 .. 2	59	.. 1 .. 3			
76	.. 2 .. 1	75	.. 2 .. 3	93	.. 1 .. 3	63	.. 2 .. 2			
97	.. 1 .. 0	91	.. 1 .. 2	47	.. 3 .. 2	47	.. 1 .. 2			
65	.. 2 .. 1	75	.. 2 .. 1	25	.. 2 .. 1	25	.. 2 .. 1			
24	.. 3 .. 2	34	.. 3 .. 2	62	.. 3 .. 1	97	.. 1 .. 0			

LONG MEASURE.

lea.	m.	fur.	m.	fur.	p.	yds.	ft.	in.	feet.	in.	ba.
27	2	7	75	7	27	75	11	2	75	11	2
1	1	1	27	5	35	24	9	1	24	10	1
71	2	5	62	1	8	65	2	10	39	3	2
65	1	9	76	3	14	27	2	11	71	10	0
27	0	5	63	7	15	92	1	7	27	9	1
19	2	7	25	2	19	37	2	1	41	7	2

LAND MEASURE.

a.	r.	p.	a.	r.	p.	a.	r.	p.	a.	r.	p.
17	3	35	35	3	39	45	2	7	97	3	25
25	1	24	27	2	17	27	1	18	71	2	26
76	2	15	14	1	25	36	2	16	35	1	16
25	1	32	62	0	33	25	3	15	97	3	27
39	3	15	27	1	19	97	1	27	25	1	35

WINE

WINE MEASURE.

<i>T. bbd. gal.</i>	<i>bbd. gal.</i>	<i>tier. gal. qts.</i>	<i>gal. qts. pts.</i>
27 .. 3 .. 61	35 .. 59 .. 2	71 .. 41 .. 3	65 .. 3 .. 1
35 .. 2 .. 27	26 .. 18 .. 2	25 .. 37 .. 1	27 .. 2 .. 0
24 .. 1 .. 35	39 .. 15 .. 3	69 .. 14 .. 2	35 .. 3 .. 1
79 .. 0 .. 26	65 .. 37 .. 1	87 .. 37 .. 1	97 .. 1 .. 0
35 .. 15 .. 1	28 .. 15 .. 3	35 .. 18 .. 2	18 .. 3 .. 1
71 .. 18 .. 1	65 .. 18 .. 1	97 .. 14 .. 3	.. 2 .. 1

ALE and BEER MEASURE.

<i>bbd. gal. qts.</i>	<i>bbd. gal. qts.</i>	<i>B.B. gal. qt.</i>	<i>A.B. gal. qt.</i>
37 .. 51 .. 3	97 .. 23 .. 3	44 .. 35 .. 3	75 .. 3 .. 2
29 .. 27 .. 2	35 .. 37 .. 2	37 .. 19 .. 2	27 .. 21 .. 1
38 .. 15 .. 1	97 .. 14 .. 1	21 .. 14 .. 1	91 .. 3 .. 3
93 .. 18 .. 1	35 .. 29 .. 2	97 .. 18 .. 3	28 .. 25 .. 2
27 .. 35 .. 2	91 .. 37 .. 1	19 .. 25 .. 2	71 .. 31 .. 3
63 .. 24 .. 1	27 .. 21 .. 3	75 .. 14 .. 3	37 .. 11 .. 2

DRY MEASURE.

<i>ch. b. p.</i>	<i>ch. bu.</i>	<i>qrs. bu. p.</i>	<i>qrs. b. p.</i>
75 .. 25 .. 1	75 .. 35 .. 3	79 .. 7 .. 3	35 .. 7 .. 2
29 .. 18 .. 3	37 .. 18 .. 2	25 .. 5 .. 1	27 .. 3 .. 1
75 .. 26 .. 2	91 .. 18 .. 3	63 .. 6 .. 2	35 .. 3 .. 1
36 .. 18 .. 1	35 .. 2 .. 2	71 .. 4 .. 3	27 .. 3 .. 1
97 .. 14 .. 1	97 .. 10 .. 1	25 .. 2 .. 1	91 .. 7 .. 2
25 .. 7 .. 3	76 .. 14 .. 2	71 .. 6 .. 2	70 .. 6 .. 3

M E.

<i>av. d. b.</i>	<i>av. d. b.</i>	<i>d. b. m.</i>	<i>d. b. m.</i>
27 .. 6 .. 21	37 .. 6 .. 21	71 .. 21 .. 57	97 .. 2 .. 15
35 .. 5 .. 19	24 .. 5 .. 18	25 .. 9 .. 31	71 .. 3 .. 27
24 .. 3 .. 14	35 .. 4 .. 17	62 .. 17 .. 25	92 .. 1 .. 35
75 .. 2 .. 18	62 .. 3 .. 20	37 .. 10 .. 16	75 .. 3 .. 18
36 .. 3 .. 15	71 .. 6 .. 16	19 .. 14 .. 15	36 .. 6 .. 21
71 .. 2 .. 17	25 .. 2 .. 18	27 .. 13 .. 27	92 .. 5 .. 88

The APPLICATION.

1. A man born in the Year 1723, when will he be 57 years of age?
Ans. 1780.

2. What is the estate worth per annum, when the taxes are 25 guineas, the net income nineteen score £18..17?
Ans. £425..2.

3. There are two numbers the less 72 their difference 17, I desire to know the greater number and the sum of both?
Ans. 89 and 161 sum.

4. There are four numbers, the first 215, the second 327, the third as much as the other too, and the fourth as much as the three, what is the sum of them all?
Ans. 2168.

5. Four Persons went partners in the purchase of a quantity of Goods. B laid out 108*d.* C. 59*s.* 6*d.* D £5 half a guinea and half a crown, and E 63*s.* 8*d.* what was laid out in all?
Ans. £12..5..2.

6. A man lent his friend at different times the following sums of money £57. £39..14. £28..15..6. and seven score and fourteen pounds, half a guinea, and 2 crowns, how much did he lend in all?
Ans. £280..10.

7. Bought a parcel of goods for which I paid £79..10..4, for packing 15*s.* 10*d.* carriage £1..7..3, and spent about the bargain 12*s.* 9*d.* what did these goods stand me in?
Ans. £82..6..2.

8. A Gentleman left his eldest daughter £1600 more than the youngest, and her fortune was £11000, 11 hundred, and twice £11. what was the eldest sister's fortune and what did the father leave them?
Ans. £15722 eldest and £5844 father left them.

SUBTRACTION of MONEY, WEIGHT, and MEASURES.

RULE. Subtract like integers, excepting when
 A lower name exceeds an upper, then
 As many as make one of the next name
 Above, must borrow'd be, and add the same
 Unto the upper, take the less away,
 Set down what's o'er, minding that one you pay
 To th' next lowest name, for what you took away.

PROOF. As in whole numbers.

Borrowed

ASSISTANT. *Subtraction of Money and Weights. 23*

£. s. d.
 Borrowed 897 .. 13 .. 7½
 Paid 350 .. 17 .. 5½

£. s. d.
 Lent 925 .. 1 .. 2
 Received 375 .. 14 .. 7½

Remains to pay 540 .. 16 .. 2

Unpaid

Proof 897 .. 13 .. 7½

Proof

£. s. d.
 72 .. 10 .. 1½
 39 .. 17 .. 4½

£. s. d.
 85 .. 12 .. 3
 27 .. 19 .. 7½

£. s. d.
 65 .. 17 .. 8½
 27 .. 9 .. 10½

£. s. d.
 71 .. 12 .. 6½
 27 .. 15 .. 7½

£. s. d.
 712 .. 3 .. 8½
 359 .. 18 .. 7½

£. s. d.
 615 .. 11 .. 10½
 372 .. 15 .. 7½

£. s. d.
 751 .. 4 .. 2½
 275 .. 9 .. 8½

£. s. d.
 17 .. 10 .. 2
 35 .. 12 .. 7½

Borrowed 35715 .. 14 .. 8

Lent £62194 .. 17 .. -

257 .. 2 .. 7½
 925 .. 10 .. 2
 716 .. 1 .. 2
 357 .. 6 .. 2½
 27 .. 10 .. 1½
 10 .. 13 .. 2

27 .. 10 .. 5
 Received 215 .. 3 .. 7½
 at 724 .. 16 .. 8½
 several 371 .. 19 .. 7½
 payments 254 .. 7 .. 6½
 371 .. 13 .. 7½

Paid in all

Remains to pay

TROY WEIGHT.

lb. oz. dwt. gr.
 27 .. 2 .. 12 .. 1
 16 .. 3 .. 9 .. 14

lb. oz. dwt. gr.
 63 .. 10 .. 12 .. 10
 27 .. 2 .. 14

oz. dwt. gr.
 71 .. 13 .. 2
 25 .. 17 .. 14

oz. dwt. gr.
 39 .. 10 .. 12
 25 .. 17 .. 2

APOTHECARYS WEIGHT.

ton. cwt. q. lb. oz. dr.
 31 .. 12 .. 1
 24 .. 7 .. 3

cwt. gr. lb.
 62 .. 1 .. 14
 27 .. 2 .. 14

lb. oz. dr.
 35 .. 12 .. 7
 26 .. 13 .. 8

lb. oz. dr.
 75 .. 1
 37 .. 8

APOTHECARIES

22 Subtraction of Measures. The New Tutor's

APOTHECARIES WEIGHTS.

lb	3	3	9	lb	3	3	9	gr.	3	3	9	gr.
71	..	5	..	1	5	..	2	..	1	..	0	4
27	..	3	..	7	..	3	..	7	..	2	5	..

CLOTH MEASURE.

E. E. grs. n.	yds. grs. n.	yds. grs. n.	E. E. grs. n.
73 .. 2 .. 1	51 .. 1 .. 2	72 .. 1 .. 0	54 .. 1 .. 0
29 .. 3 .. 2	39 .. 2 .. 3	23 .. 2 .. 1	27 .. 2 .. 3

LONG MEASURE.

bu.	f.	fur.	mi.	bu.	f.	fur.	mi.
72	..	1	..	5	67	..	1
39	..	2	..	7	35	..	2

LAND MEASURE.

a.	r.	p.	a.	r.	p.	a.	r.	p.
75	..	3	..	27	71	..	3	..
39	..	2	..	7	26	..	2	..

WINE MEASURE.

tun.	gal.	qt.	tier.	gal.	qt.	tun.	gal.	qt.
31	..	2	..	1	75	..	2	..
27	..	1	..	2	24	..	3	..

ALE and BEER MEASURE.

A. B.	fir.	gal.	B. B.	fir.	gal.	bbd.	gal.	qt.
71	..	37	..	1	97	..	3	..
29	..	14	..	2	45	..	14	..

DRY MEASURE.

cb.	bu.	p.	qu.	bu.	p.	cb.	bu.	p.
73	..	2	..	2	97	..	3	..
27	..	27	..	3	75	..	18	..

TIME.

m.	w.	d.	m.	w.	d.	m.	w.	d.
71	..	3	..	1	14	..	3	..
37	..	3	..	2	12	..	3	..

7th APPLICATION.

1. A man born in the year 1723, what was his Age in the year 1780? *Ans.* 57.

2. What is the difference between 7518 and 6750 added to 1759? *Ans.* 991.

3. What is the difference between a man born in 1723, and another in the year 1684? *Ans.* 39.

4. A merchant had six debtors, C, D, E, F, G, and H, which owed him £5219..4..6. D, E, F, G, and H owed him £3215..9..7, what is C's debt? *Ans.* £2003..14..11.

5. A horse in his furniture is worth £39..3. out of it fifteen guineas, how much does the furniture exceed that of the horse? *Ans.* £13.

6. A merchant at his out-setting in 1750 is owed £650, he had in cash, commodities, stocks, and good debts, £10270. He cleared the first year by comm. £635..4..2. What was the debt balance at the 12 months end? *Ans.* £10255..0.

7. When an estate of £425..2. per annum is reduced on paying of taxes, to nineteen score eighteen pounds, and seven shillings, what is the tax? *Ans.* £26.

8. A gentleman dying left £48000 between two daughters, the youngest was to have seventeen thousand pounds, seventeen hundred and twenty five pounds, what was the eldest sister's fortune? *Ans.* £29000.

MULTIPLICATION of MONEY DENOMINATIONS.

RULE. First by the given quantity multiply
The lowest name, divide that product by
As many as will just make one
Of the next name above, and then set down
Whate'er remains, the quotient of th' same
Add to the product of next highest name.

PROOF. By Division.

£.	s.	d.	£.	s.	d.	£.	s.	d.	£.	s.	d.
72	.. 15	.. 9½	324	.. 2	.. 8½	71	.. 13	.. 10½	87	.. 10	.. 2½
		2			4			5			6

145..11..

lb.	oz.	dwt.	oz.	dwt.	grs.	Cwt.	qrs.	lb.	BB.	fir.	gal.
72	.. 10	.. 17	35	.. 14	.. 21	205	.. 3	.. 3	327	.. 3	.. 7
		7			8			3			9

Multiplication.

The New Tutor's

Hhd.	gal.	qts.	m.	pr.	p.	yds.	f.	in.	El.	qrs.	m.								
261	..	27	..	3	374	..	7	..	3	371	..	2	..	9	363	..	3	..	3
			7				6					9							3

If more than twelve your number be, then take
Two numbers which when multiply'd will make
The given number, but if none there be
Will make it just, take the deficiency
And with it multiply the upper line,
Its product then to the last product join.

PROOF. As in the numbers.

1. 16 yards of cloth at 17s. 4d.
per yard.

$$\begin{array}{r} 4 \times 4 = 16 \\ 3..9..8 \\ 4 \\ \hline 13..18..8 \end{array}$$

2. 20 lb. of coffee
at 6s. 8d. per lb.

$$\begin{array}{r} 5 \times 5 + 1 = 26 \\ 1..13..4 \\ 5 \\ \hline 8..6..8 \\ 6..8 \end{array}$$

3. 55 firkins of butter at 16s. 4d. per firkin.

4. 36 yards of tabby at 8s. 6d. per yard.

5. 73 lb. of nutmegs, at 7s. 3d. $\frac{1}{2}$ per lb.

6. 23 ells of holland, at 8s. 4d. $\frac{1}{2}$ per ell.

7. 75 ells of diaper, at 1s. 6d. $\frac{1}{2}$ per ell.

8. 7 doz. pair of gloves, at 1s. 8d. $\frac{1}{4}$ per pair.

9. 57 doz. of candles, at 8s. 8d. $\frac{1}{2}$ per doz.

10. 98 cwt. of cheese, at 1s. 3d. 9. per cwt.

11. 133 gallons of brandy, at 11s. 6d. $\frac{1}{2}$ per gallon.

12. 125 lb. of green tea, at 8s. 3d. $\frac{1}{2}$ per lb.

Facit £51..13..10 $\frac{1}{4}$.

ASSISTANT.

Multiplication. 23

13. 85 cwt. of cheese, at £1..10. per cwt.
Facit £105..10..10.

14. 6 dozen pair of stockings, at 7s. 3d. per pair.
Facit £26..2..-

When the given quantity consists of $\frac{1}{2}$, $\frac{1}{4}$, divide by the $\frac{1}{2}$, $\frac{1}{4}$; when $\frac{1}{2}$ divide the price by $\frac{1}{2}$, and that quotient by $\frac{1}{4}$, which add to the product of the quantity given;

15. $18\frac{1}{2}$ ells of dowlas, at 1s. 4d. per ell?
 6. $6 \times 3 = 18$

$$\begin{array}{r} 8 \dots 0 = 6 \end{array}$$

$$\begin{array}{r} 3 \end{array}$$

$$\begin{array}{r} 4 \dots = \end{array}$$

$$\begin{array}{r} 1 \dots 4 \dots 8 = 18 \end{array}$$

16. $24\frac{1}{2}$ ells of holland, at 7s. 8d. $\frac{1}{2}$ per ell.

Facit £9..8..

17. $26\frac{1}{2}$ yards of tawse, at 5s. 2d. $\frac{1}{2}$ per yard.

Facit £6..10..

18. $7\frac{1}{2}$ barrels of herrings, at £3..12..7. per barrel.

Facit £27..1..4 $\frac{1}{2}$.

19. $37\frac{1}{2}$ ells of diapers, at 1s. 4d. $\frac{1}{2}$ per ell.

Facit £20..10..

20. $8\frac{1}{2}$ cwt. of Mocha raisins, at £1..3..6. per cwt.

Facit £10..5..7 $\frac{1}{2}$.

21. $35\frac{1}{2}$ cwt. of double refined sugar, at £4..17..3.

Facit £172..12..4 $\frac{1}{2}$.

22. $1\frac{1}{2}$ gallons of rum, at 8s. 3d. $\frac{1}{2}$ per gallon.

Facit £46..14..10 $\frac{1}{2}$.

23. $27\frac{1}{2}$ lb. of hyson tea, at 17s. 4d. $\frac{1}{2}$ per lb.

Facit £23..13..4 $\frac{1}{2}$.

24. $39\frac{1}{2}$ lb. of belladine silk, at 18s. 7d. per lb.

Facit £36..18..8 $\frac{1}{2}$.

25. $97\frac{1}{2}$ cwt. of currants, at £2..17..4. per cwt.

Facit £279..10..-

26. $118\frac{1}{2}$ gallons of arrack, at 12s. 8d. per gallon.

Facit £74..17..10.

27. $125\frac{1}{2}$ cwt. of hops, at £2..15..9 per cwt.

Facit £350..10..7 $\frac{1}{2}$.

28. $86\frac{1}{2}$ bushels of wheat, at 4s. 7d. per bushel.

Facit £19..16..3 $\frac{1}{2}$.

26 Multiplication.

The New Tutor's

The APPLICATION.

1. The sum of two numbers is 320, the less of them 127, what is their difference and the square of their product?

Ans. 66 diff. 600789111 square of product.

2. There are two numbers, the less of them 27 times 18, their difference 17 times 8, their sum and product are required?

Ans. 1108 sum, 302292 product.

3. What is the difference between 6 dozen dozen and half a dozen dozen, and what is their sum and product?

Ans. 792 diff. 936 sum. 62208 product.

4. What is the difference between twice five and fifty and twice fifty five, and what is their product?

Ans. 50 diff. 6600 product.

5. What sum must be divided among 27 men that each may receive £18..3..4?

Ans. £490..10.

6. A privateer of 350 men took a prize which amounted to £135..15. to each man, what was the prize?

Ans. £475..12..10.

7. A merchant had £17357 to begin trade with, for 6 years together, he cleared £1107 a year, the next four years he made good £2713 a year, but the last two years he had the misfortune to lose one year with another £235 a year, what was his real fortune at 12 years end?

Ans. £34381.

8. What sum did that gentleman receive in dowry with his wife, whose fortune was her wedding suit, her pettycoat having 3 rows of furbelows, each furbelow 76 quills, and each quill 25 guineas?

Ans. £5085.

DIVISION of several DENOMINATIONS.

RULE. The left denomination first divide,
What e'er remains must then be multiply'd
By just as many of the less, as one
Of that will make, which being justly done
You add unto the next, and so go on.

PROOF. As in whole numbers.

£. s. d.	£. s. d.	£. s. d.	£. s. d.
2)35..14..7	3)52..5..10	4)29..18..5	5)84..13..1

17..17..3½

oz. dwt. gr.	lb. oz. gr.	tons. cwt. qrs.	cwt. qrs. lb.
6)70..2..13	7)35..14..15	8)75..17..1	9)27..1..12
El. qrs. n.	EF. qrs. n.	yds. qrs. n.	m. fur. po.
10)76..4..1	11)39..2..1	11)87..1..2	12)76..7..27

768

The APPLICATION.

1. Gave £75..2..6. for 7 pieces of cloth, what is that per piece?
Ans. £10..14..7½.
2. If I gave £371..14..6. for 32 bales of cloth, what is that for 2 bales?
Ans. £23..4..7½.
3. Bought 64 yards of cloth for £78..9..4. I desire to know at what rate per yard?
Ans. £1..4..6½.
4. If a man spends £345..2..8. in 12 months time, what is that per month?
Ans. £28..15..2½.
5. The clothing of 56 charity boys comes to £90..7..6, what is the expence of each?
Ans. £1..12..3¼.
6. If 25 cwt. of tobacco comes to £32..18..4, at what rate is that per cwt.
Ans. £1..6..4.
7. If the quotient is 72152, dividend 34344352, what was the divisor?
Ans. 476.
8. What number to the 5th part of 27352 will raise it to 715?
Ans. 189.
9. Divide 201. between A, B, and C, in such sort that B may have 2s. more than A, and C 2s. more than B?
Ans. A 4s. 8d. B 6s. 8d. C 8s. 8d.
10. Suppose there are 1000 men to a regiment, and but 50 officers, how many private men are there to one officer?
Ans. 19.
11. A prize of £30255..14..7. is to be equally divided among 500 sailors, what is each man's share?
Ans. £60..10..2½.
12. A person cleared £1026 in 19 years, what did he lay by in a year?
Ans. £54.
13. Another cleared £2007..10. in 5½ years, what was his yearly increase of fortune?
Ans. £365.
14. A gentleman has a garden walled in, containing 7266 yards, the breadth 42 yards, what was the length?
Ans. 173.
15. What is the value of a barrel of beer when 132 are sold for £198?
Ans. £1..10..-
16. What number is that which multiplied by 2704, will make the product 1233024?
Ans. 456.
17. A club in London, consisting of 24 gentlemen, joined for a lottery ticket of £19 value, which came up a prize of £2000, I desire to know what each man contributed, and what each man's share came to?
Ans. each man contributed 8s. 4d. each share £83..6..8.

BILLS of PARCELS.**MILLENNERS.****Mrs. Brown,****Bought of Sarah Caps, April 29, 1781.**

		£.	s.	d.
14 Yards of fine lace	- at -	15	6	per yd. £
3 Pair of fine kid gloves	at -	2	4	per pair
10 Fans French mounts	- at -	3	8	each -
3 Fine lace tippets	- - at	3	10	- each -
5 Dozen of Irish lamb	at -	1	2	per pair
6 Sets of knots	- - - at -	2	9	per set -

£27..17..2**WOOLLEN-DRAPERS.****Mr. John Taylor,****Bought of Tim. Drugget, April 29, 1781.**

		£.	s.	d.
14 Yards of fine serge	- at -	3	10	per yd. £
16 Yards of drugget	- - at -	9	6	- - -
18 Yards of drab	- - - at -	19	4	- - -
27 Yards of shalloon	- - at -	1	10	- - -
16 Yards of superfine scarlet	at 1..	3	6	- - -
12 Yards of black ditto	- at -	17	6	- - -

£59..9..2**HOSIERS.****Mr. Edward James,****Bought of Charles Thoms, April 30, 1781.**

		s.	d.
7 Pair of milled hose	- - at	4	2 per pair £
6 Pair of cotton ditto	- - at	7	8 - - -
12 Pair of worsted stockings	at	4	10 - - -
8 Pair of thread ditto	- - at	3	6 - - -
5 Pair of black silk	- - - at	12	3 - - -
3 Yards of flannel	- - - at	1	10 - - -

£11..7..11**MERCER'S**

ASSISTANT.

Bills of Parcels. 29

M E R C E R ' S .

Mr. Ellis Thorn,

Bought of Aaron Ducape, April 30, 1781.

	s.	d.	
11 Yards of Genoa velvet	at 28	6	per yard £
18 Yards of lutestring	at 5	10	- - -
13 Yards of sattin	at 11	6	- - -
22 Yards of flowered silk	at 18	3	- - -
12 Yards of rich brocade	at 19	10	- - -
25 Yards of larsenet	at 3	4	- - -

£64..10..10

L I N E N - D R A P E R ' S .

Mr. Tobias Short,

Bought of Husley and Co. May 1, 1781.

	s.	d.	
16 Yards of printed linen	at 5	6	per yard. £
12 Ells of diaper	at 1	9	per ell -
33 Ells of dowlas	at 1	2½	- - -
5 Yards of cambrick	at 15	4	per yard -
10 Yards of muslin	at 17	8	- - -
3 Dozen of napkins	at 3	5	each -

£24..9..2½

G R O C E R ' S .

Mr. Richard Perry,

Bought of John Jones, May 4, 1781.

	s.	d.	
27 lb. of Malaga raisins	at -	5	per lb. £
29 lb. of Smyrna ditto	at -	7½	- - -
3 Loaves double refined } sugar, weight 22½ lb. }	at -	11½	- - -
28 lb. of lump sugar	at -	8¼	- - -
16 lb. of rice	at -	4	- - -
15 lb. of currants	at -	6½	- - -

£4..3..7½

D 3

CHEESE-

CHEESEMONGER'S.

Mr. George Thomas,

Bought of Jofiah Short, May 4, 1781.

	s.	d.
14 lb. of cream cheefe - - at - ..	6	per lb.
15 lb. of new ditto - - - at - ..	5	- -
$\frac{1}{2}$ Firkin of butter, wt. 27lb. at - ..	5	$\frac{1}{2}$ - -
12 lb. Cambridge ditto - - at - ..	7	$\frac{1}{2}$ - -
4 Cheshire cheefe, wt. 125lb. at - ..	5	$\frac{1}{2}$ - -
3 Warwickshire ditto, 20lb. at - ..	4	$\frac{1}{2}$ - -

£4..15..3 $\frac{1}{2}$

LEATHER-SELLER'S.

Mr. Toby Done,

Bought of Samuel Horne, May 4, 1781.

	s.	d.
13 Buck skins - - - at 11 ..	8	per skin. £
35 Calf skins - - - at 3 ..	8	- -
77 Sheep skins - - - at 1 ..	7	- -
15 Russia hides - - - at 10 ..	5	- -
35 Coloured sheep skins - at 1 ..	7	- -
320 Lamb ditto - - - at 1 ..	2	$\frac{1}{2}$ - -

£37..18..7

CORN-CHANDLER'S.

	s.	d.
Malt, 8 quarters - at 27 ..	-	per quarter £
Beans, 10 bushels - at 4 ..	7	per bushel
Tares, 18 bushels - at 1 ..	10	- -
Hops, 17 lb. - at 1 ..	6	per lb. - -
Oats, 7 quarters - at 2 ..	3	per bushel
Peas, 16 bushels - at 3 ..	8	$\frac{1}{2}$ - -

£25..5..8

REDUCTION

REDUCTION

IS the bringing or reducing numbers of one denomination into other numbers of another denomination, retaining the same value, and is performed by Multiplication and Division.

First, All *larger* names with ease you may reduce
Unto a *smaller*, which you have in use,
If by that number of the smaller name
That makes one great, you *multiply* the same.

Secondly, All *smaller* names with ease you may reduce
Unto a *greater*, which you have in use.
If by that number of the smaller name
That makes one great, you *do divide* the same.

Coins as are current in England:

Gold.

Silver.

Guinea - - -	£1 .. 1 .. -	Crown - - -	£0 .. 5 .. 0
Half ditto - -	0 .. 10 .. 6	Half ditto - - -	0 .. 2 .. 6
Quarter ditto -	0 .. 5 .. 3	Shilling - - -	0 .. 1 .. -

Note, There are several pieces which speak their own value; such as a six-pence, four-pence, three-pence, two-pence, penny, halfpenny, farthing.

In £9 how many shillings and pence?

20

180 shillings.

12

2160 pence.

2. In £14 how many shillings, pence, and farthings?

Ans. 13440 far. 3360 pence, 280 shillings.

3. How many shillings, pence and farthings are there in £20?

Ans. 400 shillings, 4800 pence, 19200 far.

4. Reduce £7 and a crown into shillings and pence.

Facit 145s. 1740d.

5. How many crowns and shillings are there in £35?

Ans. 140 cr. 700s.

6. In £27..14..3½ how many farthings?

Ans. 26606 farthings.

7. How

7. How many farthings are there in 25 guineas?
Ans. 25200 farthings.
8. In £35..3..10, how many pence?
Ans. 8446.
9. In 25 crowns how many half crowns, six-pences and pence?
Ans. 50 half-cr. 250 six-pences, 1500d.
10. In 72 half-crowns, how many pence, and farthings?
Ans. 2160 d. 8640 farthings.
11. In 56 crowns, as many half-crowns, shillings, and pence, how many farthings?
Ans. 25072 farthings.
12. How many crowns, half-crowns, six-pences, and three-pences are there in £105?
Ans. 420 crs. 840 half-crs. 4200 six-pences, 8400 three pences.

REDUCTION *Ascending.*

13. In 2160 pence, how many shillings and pounds?
Ans. 180s. £9.

$$\begin{array}{r} 12 \overline{) 2160} \\ \underline{12} \\ 9 \end{array}$$
12) 2160

210) 1810 (shillings.

9 pounds.
14. In 13440 farthings, how many pence, shillings, and pounds?
Ans. 3360d. 280s. £14.
15. Reduce 4800 pence into shillings and pounds.
Facit 400s. £20.
16. How many crowns and pounds in 1740d.
Ans. 29 crowns, £7..5.
17. In 700 shillings, how many crowns and pounds?
Ans. 140 crowns, £35.
18. How many pence, shillings, and pounds are there in 26606 farthings?
Ans. 6651 pence, 554s. £27..14..3½.
19. In 25200 farthings, how many guineas?
Ans. 25 guineas.
20. Reduce 8446 pence into pounds.
Facit £35..3..10.
21. In 1500 pence, how many six-pences, half-crowns and crowns?
Ans. 250 six-pences, 50 half-cr. 25 crown,
22. How many pence and half-crowns, are there in 8640 farthings?
Ans. 2160d. 72 half-crowns.

23. In

23. In 23072 farthings how many pence, shillings, half-crowns and crowns, and of each an equal number?

Ans. 56 of each sort.

24. How many half-crowns, crowns and pounds are there in 8400 three-pences? *Ans.* 840 half-crs, 420 crs. £105.

Ascending and Descending.

25. In 1740 pence, how many crowns and shillings?

Ans. 29 crowns, 145 shillings.

60)1740

29

5

145

26. Reduce 145 shillings into crowns and pence.

Facit £29 crowns, 1740 pence.

27. How many shillings, pounds and crowns, in 80 guineas?

Ans. 1680s. £84, 336 crowns.

28. In £84 how many crowns, shillings, and guineas?

Ans. 336 crowns, 1680 shillings, 80 guineas.

29. Reduce 60 guineas into shillings and pounds.

Facit 1260s. £63.

30. Reduce 63 pounds into shillings and guineas.

Facit 1260s. 60 guineas.

31. How many shillings, half-crowns, and crowns are there in £784. and of each an equal number?

Ans. £1844 of each, and 6s. over.

32. In 1844 crowns, half-crowns and shillings, how many pounds?

Ans. £783..14.

33. Nine men brought £17..10. each into the mint to be changed for guineas, how many must they have in all?

Ans. 150.

34. If 150 guineas are to be divided among 9 men, how many pounds sterling is that to each?

Ans. £17..10..

35. A certain person had 35 purses, and in each purse ten guineas, a crown, and a moidure of £1..7. value, how many pounds sterling had he in all?

Ans. £423..10..

36. A gentleman in his will leaves £80 to the poor, and ordered that $\frac{1}{2}$ should be given to antient men, each to have

6s.—

6s. — $\frac{1}{4}$ to poor women, each to have 3s. — $\frac{1}{2}$ to poor boys, each to have 1s. 6d. — $\frac{1}{8}$ to poor girls, each to have 1s. and the remainder to the person who distributed it. I require to know how many of each sort there were, and what the person had that distributed the money for his pains?

Ans. 88 men, 133 women, 213 boys, 266 girls, £4. 7. 6 to the person.

T R O Y W E I G H T.

37. In 36 ounces of gold, how many grains?

Ans. 17280 grains.

38. In 17280 grains of gold, how many ounces?

Ans. 36 ounces.

39. How many grains are there in 5 lb. 7 oz. 14 dwt. 6 gr.

Ans. 32502 grains.

40. In 7 ingots of silver weighing 4 lb. 2 oz. 7 dwt. 15 gr. how many ounces, pennyweights, and grains?

Ans. 50 oz. 1007 dwt. 24183 grains.

41. How many ounces, pennyweights, and grains are there in 9 ingots of silver each weighing 7 lb. 5 oz. 17 dwt. 5 grains,

Ans. 808 oz. 16174 dwt. 388197 grains.

42. In 388197 grains how many ingots of silver of 7 lb. 5 oz. 17 dwt. 5 gr. each?

Ans. 9 ingots.

43. A gentleman sent a tankard to his goldsmith that weighed 43 oz. 4 dwt. and ordered him to make it into spoons of 2 oz. 14 dwt. each, how many had he?

Ans. 16.

44. A gentleman delivered to a goldsmith 145 oz. 7 dwt. 10 gr. of silver, and ordered him to make it into tankards of 18 oz. 5 dwt. 8 gr. each, spoons of 22 oz. 11 dwt. per doz. salts of 2 oz. 17 dwts. each, and forks of 20 oz. 15 dwt. per dozen; and for every tankard, one salt, a dozen of spoons, and a dozen of forks; what is the number of each he must have?

Ans. 2 of each sort, and 16 oz. 10 dwt. 18 gr. over.

A V O I R D U P O I S E W E I G H T.

Note, There are several sorts of silk which are weighed by a great pound of 24 ounces, others by the common pound of 16 ounces, therefore,

To bring *great* pounds into common,
Multiply by 3 and divide by 2, or add one half.

To bring *small* pounds into great.
Multiply by 2, and divide by 3, or subtract one third.

Things bought and sold by the Tale.

Dozens.

12 Pieces or things make 1 Doz.

12 Dozen - - - 1 Groce

12 Groce, or 144 doz. { 1 Great
 { 1 Groce

Paper and Parchments.

24 Sheets make 1 Quire.

20 Quire - 1 Ream.

2 Reams - 1 Bundle.

1 Doz. of parch. 12 Skins

12 Skins - - 1 Roll.

45. In 59472 ounces, how many cwt.?

Ans. 33 cwt. 21 lb.

46. Reduce 33 cwt. 0 qrs. 21 lb. into quarters, pounds, and ounces?

Facit 132 qrs. 3717 lb. 59472 oz.

47. Bought 45 bags of hops, each containing 2 cwt. 2 qrs. 14 lb. and another of 160 lb. how many cwt. in the whole?

Ans. 119 cwt. 2 qrs. 6 lb.

48. In 5 ton, 19 cwt. 2 qrs. 6 lb. how many parcels of 2 cwt. 2 qrs. 14 lb. and one of 160 lb.?

Ans. 45 parcels.

49. In 470 great pounds, how many common?

Ans. 705.

50. In 705 common, how many great pounds?

Ans. 470.

51. How many parcels of 16 lb. each are there in 25 cwt. of raisins?

Ans. 175 parcels.

52. In 17 cwt. 1 qr. 25 lb. of prunes, how many pounds?

Ans. 1957.

53. Bought 36 bags of hops, each 2 cwt. 1 qr. 18 lb. and another of 154 lb. how many cwt. in the whole?

Ans. 88 cwt. 0 qrs. 18.

54. How many pounds in 37 hogheads of sugar, each weighing 10 cwt. 2 qrs.

Ans. 43512 lb.

55. How many hogheads of sugar of 10 cwt. 2 qrs. are there in 43512 lb.

Ans. 37 hogheads.

56. In 27 cwt. 2 qrs. 13 lb. of tobacco, how many parcels of 14 lb. 6 oz. each?

Ans. 215 parcels, 2 lb. 6 oz.

The allowances usually made in this weight are,
TARE, TRETT, and CLOFF.

TARE is an allowance made to the buyer for the weight of the box, barrel, bag, &c. which contains the goods bought, and is either

At so much per box, bag, or barrel, &c.

At so much per cwt. or

At so much in the gross weight.

TRETT is an allowance of 4 lb. in every 104 lb. for waste, dust, &c. made by the merchant to the buyer.

CLOFF is an allowance of 26 lb. to the citizens of London, on every draught above 3 cwt. on some sort of goods.

GROSS WEIGHT is the whole weight of any sort of goods, and that which contains it.

SUTTLE is when part of the allowance is deducted from the gross.

NEAT is the pure weight when all allowances are deducted.

RULE. When Tare's so much per box, or barrel, mind }
To multiply it by the bags you find, }
Which take from gross, the neat remains behind. }

Note. To reduce pounds into gallons, multiply by 2, divide by 15.

57. In 8 frails of raisins, each weighing 4 cwt. 2 qrs. 7 lb. gross, tare at 24 lb. per frail, how much neat weight?

or thus:

24	4 .. 2 .. 7	4 .. 2 .. 7
8	8	24
— 4)		
28) 192 (6	36 .. 2 .. 0 = gross.	4 .. 1 .. 11
168 .. 1 .. 2 .. 24	1 .. 2 .. 24 = tare.	8
—		—

58. In 273 barrels of figs, each 2 qrs. 27 lb. gross, tare 11 lb. per barrel, how many pounds neat? *Ans.* 19656.

59. What is the neat weight of 27 hogheads of tobacco, weighing gross 192 cwt. 3 qrs. 17 lb. tare 100 lb. per hoghead? *Ans.* 168 cwt. 3 qrs. 5 lb.

60. In 18 bags of pepper, each 79 lb. 3 oz. gross, tare per bag 3 lb. 8 oz. how many pounds neat? *Ans.* 1362 lb. 6 oz.

RULE 2. When tare's allow'd so much in the whole weight,
Subtract it from the gross, the rest is neat.

61. What is the neat weight of 7 hogheads of tobacco,
weighing gross 97 cwt. 2 qrs. 12 lb. tare in the whole 86 lb?

Ans. 89 cwt. 3 qrs. 16 lb.

62. In 64 barrels of figs, each 2 qrs. 16 lb. gross, tare in
the whole 572 lb. how much neat weight?

Ans. 36 cwt. 0 qr. 4 lb.

RULE 3. When tare's at so much per hundred weight, divide
The gross by its ev'n parts, and so provide
The total tare, which from the gross subtract
Whate'er remains will be the neat exact.

Nota. 7 lb. is $\frac{1}{8}$. 8 lb. is $\frac{1}{4}$. 14 lb. is $\frac{1}{2}$. 16 lb. is $\frac{3}{4}$.

63. What is the neat weight of 16 butts of currants, each
8 cwt. 2 qrs. 18 lb. tare at 14 lb. per cwt.?

8 .. 2 .. 18

4

34 .. 2 .. 16

4

14 = $\frac{1}{2}$ 138 .. 2 .. 8

17 .. 1 .. 8

121 .. 1 .. 0 *Ans.*

64. In 27 barrels of figs, each 2 cwt. 2 qrs. gross, tare
16 lb. per cwt. how much neat weight?

Ans. 57 cwt. 3 qrs. 12 lb.

65. What is the neat weight of 10 hogheads of nutmegs,
each weighing gross 7 cwt. 3 qrs. 15 lb. tare per cwt. 16 lb?

Ans. 67 cwt. 2 qrs. 9 lb.

66. What is the neat weight of 12 casks of argol, gross
78 cwt. 3 qrs. 15 lb. tare per cwt. 14 lb?

Ans. 69 cwt. 0 qr. 3 lb.

RULE 4. Whenever Trett's allow'd beside
The tare, the futtle then divide
By twenty-six, the quotient's trett,
Which take from futtle, leaves the nett.

67. In 5 butts of currants, weighing 10 cwt. 2 qrs. 17 lb.
each gross, tare 14 lb. per cwt. trett 4 lb. per 104 lb. how
many pounds neat?

R

or thus:

10 .. 2 .. 17	10 .. 2 .. 17
4	4
48	48
28	28
14 = $\frac{1}{3}$ 1193 gross.	1193
149 tare.	5
26) 1044 futtle.	14 = $\frac{1}{3}$ 5965
40 trett.	745
1004 neat.	26) 5220
5 = No. butts.	200
5020 lb.	5020 neat.

68. In 5 cwt. 3 qrs. 25 lb. gross, tare 54 lb. trett 4 lb. per 104 lb. how many pounds neat? *Ans.* 592.

69. In 127 cwt. 2 qrs. 4 lb. gross, tare 10 lb. per cwt. trett 4 lb. per 104 lb. how much neat weight?

Ans. 111 cwt. 2 qrs. 21 lb.

70. In 18 chests of sugar, weighing 125 cwt. 1 qr. 21 lb. gross, tare 157 lb. trett 4 lb. per 104 lb. how many cwt. neat?

Ans. 119 cwt. 1 qr. 2 lb.

RULE 5. When cloff's allowed, then multiply by two, }
Divide by three, and that the cloff will shew, }
Which take from futtle, and the neat you'll view. }

71. What is the neat weight of 5 hogheads of tobacco, weighing 23 cwt. 2 qrs. 18 lb. gross, tare 7 lb. per cwt. trett 4 lb. per 104 lb. cloff 2 lb. for 3 cwt.

Ans. 21 cwt. 0 qrs. 23 lb.

7 = $\frac{1}{3}$ 23 .. 2 .. 18 gross.

1 .. 1 .. 25 $\frac{1}{2}$ tare.

$\frac{2}{3}$ 22 .. 0 .. 20 $\frac{1}{2}$ futtle.

3 .. 11 $\frac{1}{2}$ trett.

21 .. 1 .. 9 futtle.

14 cloff.

21 .. 0 .. 23 neat.

72. In

72. In 9 hogheads of tobacco, each weighing gross 4 cwt. 2 qrs. 14 lb. tare 8 lb. per cwt. trett 4 lb. per 104 lb. cloff 2 lb. per 3 cwt. how much neat weight?

Ans. 36 cwt. 3 qrs. 23 lb.

APOTHECARIES WEIGHT.

73. In 25 lb. 5 $\frac{3}{4}$. 23. 18. 2 grs. how many grains?

Ans. 146542.

74. How many lb. $\frac{3}{4}$. 3. 9. grs. are there in 146542 grains.

Ans. 25 lb. 5 $\frac{3}{4}$. 23. 18. 2 grs.

CLOTH MEASURE.

75. In 35 yards, how many nails? *Ans.* 560 nails.

76. In 87 English ells, how many yards?

Ans. 108 yards. 3 qrs.

77. In 108 yards, 3 qrs. how many English ells?

Ans. 87.

78. In 25 pieces each, containing 24 Flemish ells, how many English ells?

Ans. 360 English.

79. In 19 pieces of cloth, each 28 Flemish ells, how many yards?

Ans. 399 yards.

80. Bought 32 pieces of English stuffs, each 25 ells, how many yards?

Ans. 1000 yards.

81. In 1000 yards, how many ells English?

Ans. 800 yards.

82. In 18 bales of cloth, each 32 pieces, each 14 English ells, how many yards?

Ans. 10080.

LONG MEASURE.

83. In 48 miles, how many furlongs and poles?

Ans. 384 furlongs, 15360 poles.

84. In 9 miles, how many feet, inches, and barley-corn?

Ans. 47520 feet, 570240 inches, 1710720 barley-corns.

85. In 15360 poles, how many furlongs and miles?

Ans. 384 furlongs, 48 miles.

86. In 76 leagues, how many miles and yards?

Ans. 228 miles, 401280 yards.

40 Reduction.

The Petm Tutor's

87. How many miles and leagues are there in 401280 yards?
Ans. 228 miles, 76 leagues.

88. If from London to York be accounted 60 leagues, I demand how many miles, yards, feet, inches, and barley-corns?
Ans. 180 miles, 316800 yards, 950400 feet, 11404800 inches, 34214400 barley-corns.

89. How many barley corns will reach round the world, which is 360 degrees, each degree 69 miles, and an half?
Ans. 4755861600 barley-corns.

LAND MEASURE.

90. In 25 acres, how many roods and perches?
Ans. 100 roods, 4000 perches.

91. In 4000 perches, how many roods and acres?
Ans. 100 roods, 25 acres.

92. A person having a piece of ground, containing 38 acres, 2 poles, has a mind to dispose of 18 acres to A, I desire to know, how many perches he will have left?
Ans. 3202.

93. There are four fields to be divided into shares of 72 perches each; the first field containing 7 acres; the second, 3 acres, 4 poles; the third, 5 acres, 2 roods; and the fourth, 8 acres, 3 roods, 10 poles; I desire to know how many shares are contained therein?
Ans. 54 shares, 6 perches over.

WINE MEASURE.

94. Bought 7 tun of port wine, how many gallons and quarts?
Ans. 1764 gallons, 7056 quarts.

95. In 14112 pints, how many tuns?
Ans. 7 tuns.

96. In 7938 gallons of Canary, how many pipes and hogheads, and of each a like number?
Ans. 42 of each.

97. A gentleman ordered his butler to bottle off $\frac{2}{3}$ of 2 pipes of French wine into quarts, and the rest into pints; I desire to know how many dozen of each he had?
Ans. 56 dozen of each.

ALE and BEER MEASURE.

98. In 54 barrels of beer, how many pints? *Ans. 15552.*
 99. In 15552 pints of beer, how many barrels?
Ans. 54 barrels.
 100. In 12 barrels of ale, how many gallons and quarts?
Ans. 384 gallons, 1536 quarts.
 101. In 84 hogheads of beer, how many barrels?
Ans. 126 barrels.
 102. In 126 barrels of beer, how many hogheads?
Ans. 84.

DRY MEASURE.

103. In 130 quarters of wheat, how many bushels, pecks, gallons, and quarts?
Ans. 1040 bushels, 4160 pecks, 8320 gallons, 33280 quarts.
 104. In 33280 quarts of corn, how many quarters?
Ans. 130.
 105. In 30 chaldrons of coals, how many pecks?
Ans. 4320.
 106. In 560 lasts of corn, how many pecks?
Ans. 179200.

T I M E.

107. In 94217 hours, how many weeks?
Ans. 560 weeks, 5 days, 17 hours.
 108. How many days is it since the birth of our Saviour to Christmas, 1779? *Ans. 649779 days, 18 hours.*
 109. Stowe writes, London was built 1108 years before our Saviour's birth, how many hours is it since to Christmas, 1779?
Ans. 25307442 hours.
 110. From July 25, 1779, to October 4, 1780, how many days?
Ans. 436.
 111. From April 7, 1780, to December 5 in the same year, how many days? *Ans. 242.*
 112. From July 9, 1723, to July 20, 1780, how many years and days, allowing for the 11 days taken from September, in the year 1752, by act of Parliament?
Ans. 57 years, 20819 days.

The SINGLE RULE of THREE DIRECT:

TEACHETH, by three numbers given, to find out a fourth, in such proportion to the third, as the second is to the first.

RULE. Three numbers being given, we are taught
By this plain rule to find a fourth, that's sought.
One of the given numbers does contain
The very question ask'd, and should maintain
The *third* position in the stated case,
That like it first; the other *second*, place
The *first* and *third* must then be made the same,
The *second* brought into its lowest name;
That done, then multiply the *latter* two,
And by the *first* divide, when to your view
The *quotient* will present the *answer* true,
And its *denomination* is the same,
As that in which you left your *second* in.

1. If a pound of sugar cost $7\frac{1}{2}$. what cost 72 lb?

$$1 : 7\frac{1}{2} :: 72$$

$$\begin{array}{r} 4 \quad 30 \\ \hline \end{array}$$

$$30 \quad 4)2160$$

$$12)540$$

$$20)45$$

$$£2 \dots 5 \dots -$$

Ans. £2 .. 5 .. -

2. If a gallon of ale cost 10d. what is that per barrel?

Ans. £1 .. 6 .. 8.

3. If a pair of shoes cost 5s. 6d. what will 12 dozen come to?

Ans. £39 .. 12 .. -.

4. If 12 dozen pair of stockings cost £39. 12s. what is that per pair?

Ans. 5s. 6d.

5. If one yard of superfine cloth cost 18s. 6d. what will 24 yards come to at the same rate?

Ans. £22 .. 4 .. -.

6. If 24 yards of cloth cost £22. 4s. what is the value of 1 yard?

Ans. 18s. 6d.

7. If a pound of sugar cost 1s. 1d. $\frac{1}{2}$. what is the worth of 1 cwt.?

Ans. £6 .. 6 .. -.

8. If

ASSISTANT. *Single Rule of Three Direct.* 43

8. If I gave 6 guineas for 1 cwt. of sugar, what is that per lb.? *Ans. 11. 1d. $\frac{1}{2}$.*
9. Suppose I buy 20 pieces of cloth, each 24 ells, at the rate of 12s. 6d. per ell, what is the value of the whole? *Ans. £300.*
10. Bought 20 pieces of cloth, each 24 ells, for £300, what is that per ell? *Ans. 12s. 6d.*
11. What will 37 cwt. 3 qrs. 27 lb. of tobacco come to at 11. 6d. $\frac{1}{2}$ per lb.? *Ans. £327 .. 19 .. 9 $\frac{1}{2}$.*
12. Gave £327 .. 19 .. 9d. $\frac{1}{2}$ for 37 cwt. 3 qrs. 27 lb. of tobacco, what is that per lb.? *Ans. 11. 6d. $\frac{1}{2}$.*
13. Bought 25 yards $\frac{3}{4}$ of mullin at 7s. 3d. $\frac{1}{4}$ per yard, what does it come to? *Ans. £9 .. 8 .. 3 $\frac{1}{2}$.*
14. Bought 18 cwt. 2 qrs. 17 lb. of iron at 3d. $\frac{1}{4}$ per lb. what does it come to? *Ans. £32 .. 12 .. 9 $\frac{1}{2}$.*
15. If coffee is sold for 6d. $\frac{1}{2}$ an ounce, what must be given for 3 cwt.? *Ans. £145 .. 12 .. -.*
16. How many yards of cloth may be bought for £57 .. 16 .. -, when 4 yards $\frac{1}{2}$ cost £3 .. 12 .. -? *Ans. 72 yards $\frac{1}{2}$.*
17. If 5 lb. $\frac{1}{2}$ of Cheshire cheese cost 2s. 0d. $\frac{1}{4}$, what is the price of 1 cwt.? *Ans. £2 .. 2 .. -.*
18. If 1 cwt. of Cheshire cheese cost £2 .. 2 .. -, what must I give for 5 lb. $\frac{1}{2}$? *Ans. 2s. 0d. $\frac{1}{4}$.*
19. Bought 2 cwt. 27 lb. 8 oz. of old lead, at 17s. 6d. per cwt. what does it come to? *Ans. £1 .. 19 .. 3 $\frac{1}{2}$.*
20. If 2 cwt. 27 lb. 8 oz. be worth £1 .. 19 .. 3 $\frac{1}{2}$, what is that per cwt.? *Ans. 17s. 6d.*
21. If a gentleman's income is £500 a year, and he spends after the rate of 17s. 6d. a day, how much does he lay by at the year's end? *Ans. £180 .. 12 .. 6.*
22. If I buy 16 yards of cloth for 12 guineas, how many Flemish ells can I buy for £297 .. 14 .. 6. *Ans. 504 ells, 0 qr. 1 nail, $\frac{1}{3}$.*
23. If £297 .. 14 .. 6. will buy 504 Flemish ells, 0 qr. 1 nail, $\frac{1}{3}$, what quantity of yards can I have for £12 .. 12 .. -? *Ans. 16 yards.*
24. If 504 Flemish ells, 0 qr. 1 nail, $\frac{1}{3}$, cost £297 .. 14 .. 6. what must I give for 16 yards? *Ans. £12 .. 12 .. -.*
25. Gave £2 .. 3 .. 4 for 6 lb. of coffee, what must be given for 35 lb. 4 oz.? *Ans. £12 .. 14 .. 7.*
26. Bought 35 lb. 4 oz. of coffee for £12 .. 14 .. 7, what is the value of 6 lb.? *Ans. £2 .. 3 .. 4.*
27. If

44. Single Rule of Three Direct. The Tutor's

27. If 1 English ell, 3 qrs, cost $5s. 3d.$ what will 35 yards and half cost at the same rate? *Ans.* $£4..13..2\frac{1}{2}$.

28. Gave $£4..13..2\frac{1}{2}$ for 35 yards $\frac{1}{4}$ of cloth, what is the value of 1 ell and 3 quarters? *Ans.* $5s. 3d.$

29. If 1 ounce of gold is worth $£4..7..3.$ what is the worth of one grain? *Ans.* 2d. rem. 87.

30. If 18 yards of broad cloth cost $£12..12..-$, what is the purchase of 84 yards and $\frac{1}{4}$? *Ans.* $£59..3..-$

31. If 23 yards of Holland cost $£5..3..6.$ how many English ells can I buy for $£100$? *Ans.* 355 ells, 2 qrs, 3 nails, 23 rem.

32. If 1 cwt, 2 qrs, cost $£14..7..6.$ what must I give for 15 cwt, 3 qrs, 14 lb.? *Ans.* $£152..2..8\frac{1}{2}$.

33. Bought 8 yards of cloth for 18s. 4d. what must be given for 7 pieces, each containing 25 yards $\frac{1}{4}$? *Ans.* $£20..9..0\frac{1}{2}$.

34. If 8 oz, 9 dwt, of gold be worth $£33..15..-$, what is the value of 15 lb, 7 oz, 14 dwt, 15 grs, at the same rate? *Ans.* $£749..16..3\frac{1}{2}$. 2424 rem.

35. A draper bought 355 yards of cloth, at the rate of 35s. 7d. $\frac{1}{2}$ per English ell, how much did he pay for the whole? *Ans.* $£221..17..6.$

36. A gentleman bought a wedge of gold, which weighed 17 lb, 10 oz, 10 dwt, for $£643..10..-$, at what rate did he pay for it per ounce. *Ans.* $£3.$

37. A grocer bought 4 hogheads of sugar, each weighing neat 7 cwt, 3 qrs, 14 lb, at $£2..8..6.$ per cwt, what is the value of the 4 hogheads? *Ans.* $£76..7..9.$

38. A draper bought 9 packs of cloth, each containing 5 parcels, each parcel 9 pieces, and each piece 25 yards, and gave after the rate of $£3..12..6.$ per 5 yards, I desire to know what the 9 packs stood him in? *Ans.* $£7340..12..6.$

39. If 27 lb, of raisins cost 11s. 3d, what will 18 frails, each weighing neat 1 cwt, 2 qrs, 17 lb, come to? *Ans.* $£69..7..6.$

40. If an ounce of silver be worth 5s. 3d, what is the price of 15 ingots, each weighing 9 lb, 3 oz, 10 dwt.? *Ans.* $£439..0..7.$ 1 rem.

41. What is the price of a pack of wool, weighing 3 cwt, 3 qrs, 14 lb, at 7s. 10d, per stone? *Ans.* $£12..2..10.$

42. Bought 35 cwt, 3 qrs, 24 lb, of tobacco, at $£2..15..9$ per cwt, what does it come to? *Ans.* $£100..5..0.$ 12 rem.

43. What is the half year's rent of 559 acres of land, at 17s. 9d per acre per annum? *Ans.* $£248..1..1\frac{1}{2}$.

44. Bought

44. Bought 225 ton of lead at £15 per ton; paid carriage and other incident charges, £5 .. 15 .. - I require the value of the lead, and what it stands me in per pound?

Ans. £3380 .. 15 .. -, value 2d. $\frac{1}{2}$, 22152 rem. per lb.

45. If a pair of stockings cost 9 groats, how many dozen can I buy for £57 .. 5 .. -? *Ans.* 31 doz. 9 pair $\frac{2}{3}$.

46. Bought 29 dozen, 7 lb. of candles, after the rate of 11. 4d. $\frac{1}{2}$ per 3 lb. what did they cost me? *Ans.* £8..2..8 $\frac{1}{2}$

47. If an ounce of gold is sold for £3 .. 15 .. -, what comes 9 ingots to, each weighing 3 lb. 9 oz. 15 dwt. 22 gr. at the same price? *Ans.* £1545 .. 12 .. 2 $\frac{1}{2}$.

48. If my horse stands me in 10d. $\frac{1}{2}$ per day keeping, what will be the charge of 15 horses for the year?

Ans. £239 .. 10 .. 7 $\frac{1}{2}$.

49. A factor bought 79 pieces of stuff, which cost him £525 .. 14 .. 3. at 4s. 9d. per yard; I demand how many yards there were, and how many English ells in a piece?

Ans. 2213 $\frac{1}{2}$ and 22 ells, $\frac{3}{5}$ in a piece.

50. A gentleman hath an annuity of £975 .. 15 .. - per annum, I desire to know how much he may spend daily, that at the year's end he lay up 200 guineas, and give to the poor quarterly seven moidores, of £1..7. each? *Ans.* £1..19..10 $\frac{1}{2}$.

RULE of THREE INVERSE.

INVERSE PROPORTION is, when more requires less, and less requires more. More requires less, is when the third term is greater than the first, and requires the fourth term to be less than the second. And less requires more, is when the third term is less than the first, and requires the fourth term to be greater than the second.

RULE. The former terms must first be multiply'd, And then that product by the third divide;

The quotient rising thence (if done with care)

Will to the middle that proportion bear,

As does between the first and third appear.

EXAMPLES.

1. If 12 men can do a piece of work in 18 days, how many days can 24 men perform the same in?

$$12 : 18 :: 24 : 9$$

$$\frac{12}{24} \times 18 = 9$$

$$24 \overline{) 216} \text{ (9 days.)}$$

$$\underline{216}$$

$$\underline{\quad}$$

46 *Rule of Three Inverse.* *The NEW TUTOR'S*

2. If 56 men can build a house in 85 days, how many men can do the same in 45 days? *Ans.* 105 men, 35 rem.

3. If when a peck of wheat is sold for 2s. 4d. the penny loaf weighs 8 oz. how much should it weigh when the peck is worth but 1s. 6d.? *Ans.* 13 oz. 7 dr. $\frac{1}{2}$.

4. How many pieces of money of 22s. value are equal to 256 pieces of 14s. each? *Ans.* 162, 20 rem.

5. How many yards of five quarters wide are equal in measure to 40 yards of seven quarters wide? *Ans.* 56 yards.

6. If I lend my friend £250 for 12 months, how long ought he to lend me £125 to requite my kindness? *Ans.* 24 months.

7. If for 25s. I have 1400 lb. carried 38 miles, how many pounds can I have carried 28 miles for the same money? *Ans.* 1900 lb.

8. If 150 workmen finish a piece of work in 18 days, how many men are sufficient to finish it in 6 days? *Ans.* 450 men.

9. An army besieging a town, in which were 1200 soldiers, with provisions for four months, how many soldiers departed when the provisions lasted them 8 months? *Ans.* 600.

10. If £18 worth of wine is sufficient to serve an ordinary of 80 men, when the tun is sold for £36. how many will £18 suffice when the tun is sold for £24? *Ans.* 120 men.

11. A courier makes a journey in 27 days, when the day is but 8 hours long, how many days will he be going the same journey, when the days are 12 hours long? *Ans.* 18 days.

12. How much plush is sufficient for a cloak, which has in it 5 yards of six quarters wide of stuff for the lining, the plush being but 3 quarters wide? *Ans.* 10 yards.

13. If 15 pioneers make a trench in 20 days, how many days will 36 take to do the same in? *Ans.* 8 days $\frac{2}{3}$.

14. Borrowed of my friend £84 for 8 months, and he hath occasion to borrow of me another time for 12 months, how much must I lend him to requite his former kindness to me? *Ans.* £56.

15. A regiment of soldiers, consisting of 1200 men, are to have new coats, each coat to contain 2 yards and $\frac{1}{2}$ of cloth, 5 quarters wide, and to be lined with shalloon of 3 quarters wide, I demand how many yards of shalloon will line them? *Ans.* 5000 yards.

The DOUBLE RULE of THREE

IS so called, because it is composed of 5 numbers given to find a sixth, which, if the proportion is direct, must bear such proportion to the fourth and fifth, as the third bears to the first and second. But if inverse, the sixth number must bear such proportion to the fourth and fifth, as the first bears to the second and third. The three first terms are a supposition; the two last a demand.

RULE. Let the chief cause suppos'd of loss or gain,
Action or passion the first place maintain;
That which shews time, or distances of place,
Must always occupy the second space,
The other term the third; of the demand,
Each term beneath one like itself must stand,
If under the last term the blank you find
The product of the first and second mind,
Will a division make, the other three,
When multiply'd, a dividend will be.
If in another place the blank should fall,
The third and fourth, when multiply'd, we call
Divisor then—the product of the three
That's left behind a dividend will be,
And in the quotient you'll the answer see.

PROOF. By two single Rules of Three.

EXAMPLES.

1. If 20 horses eat 78 bushels of oats in 18 days, how many bushels will be sufficient for 26 horses 27 days?

By two single rules.

or in one flating.

Worked it bus

bor. bu. bor. bu.

bor. da. bu.

$$1. A_{20}: 78 :: 26: 101\frac{2}{3}$$

20:18:78 78x26x27

days. bu. days. bu.

$$26:27: \text{---} = 152, \frac{1}{3}$$
$$2. A_{18}: 101^2 : : 27 : 152$$

20X18

2. If 8 men in 16 days can mow 120 acres of grass, how many men must there be to mow 2400 acres in 10 days?

acres. days. acres. days.

men.days.acres.

$$1. A: 120 : 16 :: 2400 : 320$$

8:16:120 8x16x2400

days. men. days. men.

1975

$$2. A_{320} : 8 :: 10 : 256$$
$$-:10:2400 \text{ —————} = 256$$

3. IF

48 *Double Rule of Three.* *The New Tutor's*

3. If £100 in 12 months gain £5 interest, how much will £80 gain in 9 months? *Ans. £3.*

4. If a carrier receives £2 .. 10 .. for the carriage of 3 cwt. 144 miles, how much ought he to receive for the carriage of 8 cwt. 2 qrs. 14 lb. for 48 miles. *Ans. £2 .. 7 .. 11.*

5. If a regiment of soldiers, consisting of 875 men, consume 2457 qrs. of wheat in 122 days, how many quarters of wheat will 12542 soldiers consume in 64 days? *Ans. 18474 quarters.*

6. If 36 acres of grass be mowed by 9 men in 6 days, how many acres can be mowed by 24 men in 48 days? *Ans. 672 acres.*

7. If 45 shillings will pay 9 men for 7 days work, how much will pay 32 men for 28 days work? *Ans. £32.*

8. If £100 in 12 months gain £5 interest, what principal will gain £3 in 9 months? *Ans. 80.*

9. If a regiment, consisting of 876 soldiers, consume 2458 quarters of wheat in 122 days, how many soldiers will eat 1508 quarters in 64 days? *Ans. 1024.*

10. In a family consisting of 8 persons, there are drank out 3 kilderkins of beer in 10 days, how many kilderkins will there be drank out by another family of 15 persons in 12 days? *Ans. 6 hild. 13 gal. $\frac{1}{2}$.*

11. If the carriage of 60 cwt. 20 miles cost £14 .. 10 .., what weight can I have carried 30 miles for £5 .. 8 .. 9. at the same rate? *Ans. 15 cwt.*

12. If 13 horses eat 25 bushels of corn in 21 days, how much corn will be sufficient for a regiment, consisting of 596 horses, for 17 days? *Ans. 113 qrs. 7 bu. $\frac{1}{3}$.*

13. How long time was £976 .. 15 .. 6. in gaining £271 .. 9 .. 4. at 6 per cent. per annum? *Ans. 4 yrs. 7 months, 17 days.*

14. A usurer lent £250 to receive interest for the same, and when it had continued 9 months, he received for principal and interest £261 .. 5 .. . I demand at what rate of interest he received for the same? *Ans. £6 per cent.*

PRACTICE.

P R A C T I C E.

Of a Pound.	Of a Shilling.	Of a Ton.	Of an Cwt.
s. d.	d.	cwt.	qrs. lb.
10.. - is - $\frac{1}{2}$	6 - is - $\frac{1}{2}$	10 - is - $\frac{1}{2}$	2 or 56 - is $\frac{1}{2}$
6.. - - - $\frac{1}{4}$	4 - - - $\frac{1}{4}$	5 - - - $\frac{1}{4}$	1 or 28 - - $\frac{1}{4}$
5.. - - - $\frac{1}{5}$	3 - - - $\frac{1}{5}$	4 - - - $\frac{1}{5}$	14 - - - $\frac{1}{5}$
4.. - - - $\frac{1}{4}$	2 - - - $\frac{1}{4}$	2 $\frac{1}{2}$ - - $\frac{1}{4}$	Of a Quarter.
3.. 4 - - $\frac{1}{8}$	1 $\frac{1}{2}$ - - $\frac{1}{8}$	2 - - - $\frac{1}{10}$	14 - - - $\frac{1}{2}$
2.. 6 - - $\frac{1}{4}$	1 - - - $\frac{1}{12}$		7 - - - $\frac{1}{4}$
2.. - - - $\frac{1}{10}$			4 - - - $\frac{1}{7}$
1.. 8 - - $\frac{1}{12}$			3 $\frac{1}{2}$ - - $\frac{1}{8}$

RULE 1. Less than a penny if the price should be
With care, what are its even parts first see,
By that divide, by twelve and twenty too,
And in the quotient you'll the answer view.

$\frac{1}{4}$ is $\frac{1}{4}$ 6724 lb. at $\frac{1}{4}$	7125 at $\frac{1}{2}$ Facit £14..16..10 $\frac{1}{4}$	6381 at $\frac{3}{4}$ Facit £19..18..9 $\frac{3}{4}$
12)1681	6294 at $\frac{1}{2}$ Facit £13..2..3	8457 at $\frac{3}{4}$ Facit £26..8..6 $\frac{3}{4}$
2 0)14 0..1		
£7..0..1		

RULE 2. Less than a shilling should the price appear,
Take even part or parts that in it are;
Divide their sum when added by a score,
The quote will be the answer as before.

12)6391 at 1d.	$\frac{1}{2}$ is $\frac{1}{2}$ 6710 at 1d. $\frac{1}{2}$	8459 at 2d. $\frac{1}{2}$ Facit £88..2..3 $\frac{1}{2}$
2 0)53 2..7	2 0)83 8..9	6710 at 2d. $\frac{3}{4}$ Facit £76..17..8 $\frac{3}{4}$
£26..12..7	£41..18..9	
1d. $\frac{1}{2}$)6574 at 1d. $\frac{1}{2}$	2793 at 1d. $\frac{1}{2}$ Facit £20..7..3 $\frac{1}{2}$	5925 at 3d. Facit £74..1..3
$\frac{1}{2}$ $\frac{1}{2}$) 547..10	6075 at 2d. Facit £50..12..6	9710 at 3d. $\frac{1}{2}$ Facit £131..9..9 $\frac{1}{2}$
136..11 $\frac{1}{2}$		
2 0)68 4..9 $\frac{1}{2}$	7218 at 2d. $\frac{1}{2}$ Facit £67..13..4 $\frac{1}{2}$	6519 at 3d. $\frac{1}{2}$ Facit £95..1..4 $\frac{1}{2}$
£34..4..9 $\frac{1}{2}$		

8570 at $3d.\frac{1}{2}$
Facit £133..18..1 $\frac{1}{2}$

4005 at $4d.$
Facit £66..15..—

6710 at $4d.\frac{1}{2}$
Facit £118..16..3 $\frac{1}{2}$

2591 at $4d.\frac{1}{2}$
Facit £48..11..7 $\frac{1}{2}$

7527 at $4d.\frac{1}{2}$
Facit £148..19..5 $\frac{1}{2}$

3700 at $5d.$
Facit £77..1..8

9720 at $5d.\frac{1}{2}$
Facit £212..12..6

8100 at $5d.\frac{1}{2}$
Facit £185..12..6

7563 at $5d.\frac{1}{2}$
Facit £181..3..11 $\frac{1}{2}$

2751 at $6d.$
Facit £68..15..6

9504 at $6d.\frac{1}{2}$
Facit £247..10..—

3710 at $6d.\frac{1}{2}$
Facit £100..9..7

2574 at $6d.\frac{1}{2}$
Facit £72..7..10 $\frac{1}{2}$

5004 at $7d.$
Facit £145..19..—

2710 at $7d.\frac{1}{2}$
Facit £81..17..5 $\frac{1}{2}$

2597 at $7d.\frac{1}{2}$
Facit £81..3..1 $\frac{1}{2}$

7100 at $7d.\frac{1}{2}$
Facit £229..5..5

6200 at $8d.$
Facit £206..13..4

3000 at $8d.\frac{1}{2}$
Facit £103..2..6

7156 at $8d.\frac{1}{2}$
Facit £253..8..10

3701 at $8d.\frac{1}{2}$
Facit £134..18..7 $\frac{1}{2}$

9274 at $9d.$
Facit £347..15..6

2714 at $9d.\frac{1}{2}$
Facit £104..12..0 $\frac{1}{2}$

7105 at $9d.\frac{1}{2}$
Facit £281..14..9 $\frac{1}{2}$

9251 at $9d.\frac{1}{2}$
Facit £375..16..5 $\frac{1}{2}$

7104 at $10d.$
Facit £296..—..—

9251 at $10d.\frac{1}{2}$
Facit £395..1..10 $\frac{1}{2}$

6284 at $10d.\frac{1}{2}$
Facit £274..18..6

4195 at $10d.\frac{1}{2}$
Facit £187..18..0 $\frac{1}{2}$

3275 at $11d.$
Facit £150..2..1

7510 at $11d.\frac{1}{2}$
Facit £352..0..7 $\frac{1}{2}$

3530 at $11d.\frac{1}{2}$
Facit £162..1..3

9710 at $11d.\frac{1}{2}$
Facit £475..7..8 $\frac{1}{2}$

RULE 3. More than one shilling, and if less than two,
 You e'er should find the price of goods; this do,
 Take parts with the odd money as before,
 And to them add the quantum; by a score
 Divide that sum, and all your work is o'er.

$\frac{1}{2}$ $\frac{1}{4}$ 7510 at $12d.\frac{1}{2}$
 156..5 $\frac{1}{2}$

2|0)766|6..5 $\frac{1}{2}$
 £383..6..5 $\frac{1}{2}$

$\frac{1}{2}$ $\frac{1}{4}$ 9725 at $12d.\frac{1}{2}$
 405..2 $\frac{1}{2}$

2|0)1013|0..2 $\frac{1}{2}$
 £506..10..2 $\frac{1}{2}$

7104 at $12d.\frac{1}{2}$
Facit £377..8..—

3900 at $1s. 1d.$
Facit £211..5..—

7295 at 1s. 1d. $\frac{1}{2}$ Facit £402..14..10 $\frac{1}{2}$	9760 at 1s. 4d. $\frac{1}{2}$ Facit £681..3..4..—	2145 at 1s. 8d. $\frac{1}{2}$ Facit £177..17..9 $\frac{1}{2}$
2104 at 1s. 1d. $\frac{1}{2}$ Facit £118..7..—	4715 at 1s. 5d. Facit £333..19..7	3500 at 1s. 8d. $\frac{1}{2}$ Facit £298..19..2
2793 at 1s. 1d. $\frac{1}{2}$ Facit £160..0..3 $\frac{1}{2}$	6710 at 1s. 5d. $\frac{1}{2}$ Facit £482..5..7 $\frac{1}{2}$	2900 at 1s. 8d. $\frac{1}{2}$ Facit £250..14..7
2710 at 1s. 2d. Facit £158..1..8	8510 at 1s. 5d. $\frac{1}{2}$ Facit £620..10..5	4750 at 1s. 9d. Facit £415..12..6
7102 at 1s. 2d. $\frac{1}{2}$ Facit £421..13..7 $\frac{1}{2}$	3750 at 1s. 5d. $\frac{1}{2}$ Facit £277..6..10 $\frac{1}{2}$	2767 at 1s. 9d. $\frac{1}{2}$ Facit £244..19..10 $\frac{1}{2}$
3715 at 1s. 2d. $\frac{1}{2}$ Facit £224..8..11	2504 at 1s. 6d. Facit £187..16..—	3104 at 1s. 9d. $\frac{1}{2}$ Facit £278..1..4
3719 at 1s. 2d. $\frac{1}{2}$ Facit £228..11..3 $\frac{1}{2}$	3714 at 1s. 6d. $\frac{1}{2}$ Facit £282..8..9 $\frac{1}{2}$	4702 at 1s. 9d. $\frac{1}{2}$ Facit £426..2..4 $\frac{1}{2}$
6280 at 1s. 3d. Facit £397..10..—	9215 at 1s. 6d. $\frac{1}{2}$ Facit £710..6..5 $\frac{1}{2}$	2716 at 1s. 10d. Facit £248..19..4
7150 at 1s. 3d. $\frac{1}{2}$ Facit £454..6..5 $\frac{1}{2}$	3670 at 1s. 6d. $\frac{1}{2}$ Facit £239..16..10 $\frac{1}{2}$	3710 at 1s. 10d. $\frac{1}{2}$ Facit £343..18..11 $\frac{1}{2}$
2719 at 1s. 3d. $\frac{1}{2}$ Facit £175..12..0 $\frac{1}{2}$	2900 at 1s. 7d. Facit £229..11..6	2195 at 1s. 10d. $\frac{1}{2}$ Facit £205..15..7 $\frac{1}{2}$
6120 at 1s. 3d. $\frac{1}{2}$ Facit £401..12..6	4927 at 1s. 7d. $\frac{1}{2}$ Facit £395..3..8 $\frac{1}{2}$	4900 at 1s. 10d. $\frac{1}{2}$ Facit £464..9..7
9756 at 1s. 4d. Facit £650..8..—	3710 at 1s. 7d. $\frac{1}{2}$ Facit £301..8..9	3715 at 1s. 11d. Facit £356..0..5
7000 at 1s. 4d. $\frac{1}{2}$ Facit £473..19..2	9000 at 1s. 7d. $\frac{1}{2}$ Facit £740..12..6	4192 at 1s. 11d. $\frac{1}{2}$ Facit £406..2..—
3725 at 1s. 4d. $\frac{1}{2}$ Facit £256..1..10 $\frac{1}{2}$	4193 at 1s. 8d. Facit £349..8..4	3710 at 1s. 11d. $\frac{1}{2}$ Facit £363..5..5

RULE 4. Should e'er the given price be found
Of even shillings not a pound,
By half the price then multiply
The quantum, lay the product by,
Double the units place 'twill be
Shillings—but pounds the rest you'll see.

7105 at 2s. Facit £710..10..—	*4715 at 10s. Facit £2357..10..—	9710 at 16s. Facit £7768..—..—
3710 at 4s. Facit £742..—..—	3194 at 12s. Facit £1916..8..—	2195 at 18s. Facit £1975..10..—
5974 at 6s. Facit £1792..4..—	6927 at 14s. Facit £4848..18..—	4710 at 16s. Facit £3768..—..—
7951 at 8s. Facit £3180..8..—	2100 at 16s. Facit £1680..—..—	2957 at 18s. Facit £2661..6..—

* Note, When the price is 10s. take half the quantity, and if any remains it is 10s.

RULE 5. If shillings odd you have, take this advice,
To multiply the quantum by the price;
By twenty then divide, 'tis finish'd in a trice. }

2595 at 1s. Facit £129..15..—	1950 at 7s. Facit £682..10..—	2100 at 15s. Facit £1575..—..—
7215 at 3s. 3 210)2164 5 £1082..5..—	2714 at 9s. Facit £1221..6..—	710 at 17s. Facit £603..10..—
2570 at 5s. Facit £642..10..—	7105 at 11s. Facit £3907..15..—	3104 at 19s. Facit £2948..16..—
	2750 at 13s. Facit £1787..10..—	2190 at 19s. Facit £2080..10..—

Note, When the price is 5s. divide the quantity by 4, and if any remains it is 5s.

RULE 6. When'er the price is pence and shillings too,
And of a pound some even part; this do,
Divide by it, and you'll the answer view. }

If 'tis no even part, let quantum be
By shillings multiply'd, the rest you see
Take parts with, by a score divide their sum,
And from the quote you'll find the answer come.

6..8	$\frac{1}{3}$	7216 at 6s. 8d. Facit £2405..6..8
		2570 at 3s. 4d. Facit £428..6..8
		3510 at 2s. 6d. Facit £438..15..-
		2754 at 1s. 8d. Facit £229..10..-
		6320 at 1s. 4d. Facit £421..6..8
		3204 at 1s. 3d. Facit £200..5..0
2	$\frac{1}{6}$	5270 at 3s. 2d. 3 15810 878..4 1668 8..4 £834..8..4
2 0		2517 at 4s. 5d. Facit £555..16..9

2759 at 5s. 3d. Facit £724..4..9
1976 at 7s. 4d. $\frac{1}{2}$ Facit £728..13..-
7104 at 5s. 8d. $\frac{1}{4}$ Facit £2020..4..-
3210 at 15s. 3d. $\frac{1}{2}$ Facit £4854..6..3
1925 at 17s. 7d. $\frac{1}{2}$ Facit £1696..8..1 $\frac{1}{2}$
274 at 14s. 8d. $\frac{3}{4}$ Facit £201..15..9 $\frac{1}{2}$
3710 at 9s. 5d. $\frac{1}{2}$ Facit £1754..10..5
2194 at 13s. 8d. $\frac{1}{2}$ Facit £1501..10..4 $\frac{1}{2}$
1004 at 15s. 7d. $\frac{3}{4}$ Facit £785..8..5
359 at 19s. 2d. $\frac{1}{2}$ Facit £344..15..9 $\frac{1}{2}$

RULE 7. If e'er the price is pounds and shillings, mind
Multiply quantum by the pounds you find,
Proceed with shillings if they even be
By rule the fourth, if odd take parts, then see
The sum of all; that will the answer be.

When shillings, pence, and pounds there are
Contain'd in price; in that affair
By pounds be quantum multiply'd,
By rest (if even parts) divide,
Their sum the answer will provide.

64 Practice.

The New Tutor's

When farthings, shillings, pence, and pounds there be

In price, and yet no even parts you see,
Of pounds and shillings simple shillings make,
The quantum multiply by them, and take
Parts for the pence and farthings you have o'er,
Divide the sum of all by just a score.

Note, When the given quantity is no more than three figures, proceed as in Compound Multiplication.

4	$\frac{1}{4}$	2793 at £8..4..-	2719 at £1..17..8
		8	Facit £5120..15..8
		23344	7215 at £2..18..6
		558..12	Facit £21103..17..6
		£22902..12	1975 at £1..17..7 $\frac{1}{2}$
		1175 at £1..11..-	Facit £3715..9..4 $\frac{1}{2}$
		Facit £1821..5..-	1705 at £3..3..4
		2759 at £3..6..8	Facit £5399..3..4
1	$\frac{1}{2}$	Facit £9196..13..4	7193 at £6..1..3
2	$\frac{1}{2}$	2716 at £7..3..-	Facit £43607..11..3
		7	3040 at £1..15..3 $\frac{1}{2}$
		19012	Facit £5364..6..8
6	$\frac{1}{2}$	339..10	4196 at £2..15..4 $\frac{1}{4}$
		67..10	Facit £11613..16..1
		19419..8	1973 at £1..14..7 $\frac{1}{2}$
		1795 at £2..6..-	Facit £3415..15..1 $\frac{1}{2}$
		Facit £4128..10..-	2104 at £5..7..3 $\frac{3}{4}$
6	$\frac{1}{2}$	7150 at £2..3..9 $\frac{1}{2}$	Facit £11289..5..6
		43	275 at £2..13..8 $\frac{1}{4}$
		507450	Facit £738..4..-
3	$\frac{1}{2}$	3575	79 at £25..15..8 $\frac{1}{2}$
		1787..6	Facit £2037..-11 $\frac{1}{2}$
		297..11	39 at £31..2..5 $\frac{1}{2}$
210		5131019..5	Facit £1213..15..10 $\frac{1}{2}$
		15655..10..5	

RULE 8. When divers names the price and quantum are,
First by the quantum's integers with care
Let price be multiply'd, then with the rest
Take parts; but mind, the shortest are the best.

1. At £2..18..3. per cwt. what is the value of 27 cwt.
3 qrs. 14 lb. of tobacco?

2	1	3	£2 .. 18 .. 3
			9
			26 .. 4 .. 3
			3
			78 .. 12 .. 9
1	1	1	1 .. 9 .. 1 1/2
16			- .. 14 .. 6 3/4
14	1	1	- .. 7 .. 3 1/4
			81 .. 3 .. 8 1/2

2. At £1..5..7. per cwt. what comes 15 cwt. 2 qrs. 15 lb.
of cheese to? *Ans.* £19..19..11 1/2.

3. Sold 87 cwt. 1 qr. 8 lb. of cheese at £1..7..6. per cwt.
what does it come to? *Ans.* £120..1..3 1/2.

4. Hops at £4..7..7. per cwt. what mult be given for
75 cwt. 2 qrs. 18 lb.? *Ans.* £331..6..7 1/2.

5. At £2..1..7. per cwt. what is the value of 26 cwt.
3 qrs. 15 lb. of Malaga raisins? *Ans.* £55..17..10 1/2.

6. Bought 29 cwt. 3 qrs. 21 lb. of currants, at £2..15..9.
per cwt. what did I give for the whole? *Ans.* £83..9..-

7. Sold 54 cwt. 2 qrs. 17 lb. of sugar, at £2..16..8. the
cwt. what does it come to? *Ans.* £154..16..11.

8. Tobacco at £3..15..7 1/2. the cwt. what is the worth of
29 cwt. 1 qr. 18 lb.? *Ans.* £111..4..1 1/2.

9. At four guineas and a half the cwt. what is the value of
35 cwt. 2 qrs. 16 lb. of double refined sugar? *Ans.* £168..8..3.

10. Bought sugar at three guineas and a half the cwt.
what is the value of 12 cwt. 3 qrs. 10 lb.? *Ans.* £47..3..8 1/2.

11. At £4..14..4. the cwt. what is the value of 109 cwt.
1 qr. 18 lb. of tobacco? *Ans.* £516..1..1/4.

12. Soap at £2..15..9. the cwt. what is the value of
57 cwt. 21 lb.? *Ans.* £159..8..2 1/2.

INTEREST.

I N T E R E S T.

INTEREST is either SIMPLE or COMPOUND.

SIMPLE INTEREST

IS the PROFIT allowed in lending or forbearance of any sum of money, for a determined space of time.

The PRINCIPAL is the money lent, for which Interest is to be received.

The RATE PER CENT. is a certain sum agreed on between the borrower and the lender, to be paid for every £100. for the use of the Principal 12 months.

The AMOUNT is the Principal and Interest added together.

INTEREST is also applied to Commission, Brokage, Purchasing of Stocks, Insurance, &c.

RULE. One hundred pounds for the first number take,
 The rate per cent. the second you must make
 The given sum the third, and then 'twill be
 A simple question in the Rule of Three.
 If giv'n years, by th'int'rest of a year
 You multiply, the answer will appear.

EXAMPLES.

1. What is the interest of £275 for one year at 5 per cent. per annum?

$$\begin{array}{r} 5 \\ \hline 1375 \\ 20 \\ \hline 15100 \end{array}$$

Ans. £13..15..-

2. What is the interest of £579. for one year, at 4 per cent. per annum?

Ans. £23..3..2.

3. What is the interest of £796..10..- for a year, at 5 per cent. per annum?

Ans. £39..16..6.

4. What is the interest of £648..15..- for 5 years, at 4 per cent. per annum?

Ans. £129..15..-

5. What is the interest of £756..17..6. for 4 years, at 5 per cent. per annum?

Ans. £151..7..6.

6. What is the interest of £363..18..7. for one year, at 3 per cent. per annum?

Ans. £10..18..4.

COM.

C O M M I S S I O N

Is an allowance from merchants to their factors or correspondents, in the buying and selling of goods, and is generally at a certain rate per cent. according to the custom of the country where the factor resides.

RULE. *The same as Interest.*

7. What is the commission of £279..15..- at $3\frac{1}{2}$ per cent.?

Ans. £9..15..9 $\frac{1}{2}$

$$\begin{array}{r} 839..5..- = 3 \\ 139..17..6 = \frac{1}{2} \\ \hline 9179..2..6 = 3\frac{1}{2} \\ 20 \\ \hline 15182 \\ 12 \\ \hline 9190 \\ 4 \\ \hline 3160 \end{array}$$

8. What must I allow my correspondent for disbursing on my account £476..14..10. at $2\frac{1}{2}$ per cent.?

Ans. £10..14..6 $\frac{1}{2}$. 62 rem.

9. My correspondent writes me word that he has bought goods to the amount of £658..18..- on my account, what does his commission come to at $2\frac{1}{2}$ per cent.?

Ans. £16..9..5 $\frac{1}{2}$. 6 rem.

10. If I allow my factor $3\frac{1}{2}$ per cent. for commission, what may he demand on the laying out £973..2..10?

Ans. £36..9..10 $\frac{1}{4}$. 1 rem.

PURCHASING of STOCKS.

RULE. *The same as Interest.*

11. What is the purchase of £784..15..- Bank Stock, at $127\frac{1}{2}$ per cent.?

12. What is the purchase of £289..3..- Bank Annuities, at $75\frac{1}{2}$ per cent.?

58 Interest.

$$\begin{array}{r} 784..15 \\ \underline{9} \end{array} 3 \times 9 = 27$$

$$\begin{array}{r} 7062..15 \\ \underline{3} \end{array} = 9$$

$$21188..5 = 27$$

$$392..7..6 = \frac{1}{2}$$

$$196..3..9 = \frac{1}{4}$$

$$217|76..16..3 = 27\frac{1}{2}$$

20

15|36

12

4|35

4

1|40

£217..15..4 $\frac{1}{2}$

784..15..-

£1002..10..4 $\frac{1}{2}$ Answer.

The New Tutor's

$$\begin{array}{r} 289..3 \\ \underline{9} \end{array} 9 \times 8 + 3 = 75$$

$$\begin{array}{r} 2602..7 \\ \underline{8} \end{array}$$

$$20818..16 = 72$$

$$867..9 = 3$$

$$72..5..9 = \frac{1}{2}$$

$$36..2..10\frac{1}{2} = \frac{1}{4}$$

$$217|94..13..7\frac{1}{2} = 75\frac{1}{2}$$

20

18|93

12

11|23

£217..18..11 Answer.

13. At 104 $\frac{1}{2}$ percent. what is the purchase of £554..15..-. South-sea Stock? *Ans.* £579..-.4 $\frac{1}{2}$.

14. At 69 $\frac{1}{2}$ per cent. South-sea Annuities, what is the purchase of £215..17..-? *Ans.* £150..16..6 $\frac{1}{2}$. 78 rem.

15. What is the purchase of £1045..18..-. Old South-sea Annuities, at 72 $\frac{1}{2}$ per cent.? *Ans.* £754..7..1 $\frac{1}{2}$. 16 rem.

16. At 65 $\frac{1}{2}$ per cent. what is the purchase of £583..16..-. Bank Annuities? *Ans.* £383..16..11 $\frac{1}{2}$. 56 rem.

17. What is the purchase of £759..15..-. India Stock, at 124 $\frac{1}{2}$ per cent.? *Ans.* £946..16..9.

B R O K A G E

Is an allowance to brokers, for helping merchants or factors to persons to buy or sell them goods.

RULE. By just a cent. divide the given sum,
From quote take parts with rate, the answer'll come.

13 15

18. If I employ a broker to sell goods for me to the value of £27|37..18..6. what is the brokage at 4s. per cent.?

$$\begin{array}{r} 20 \\ \hline 7|58 \\ 12 \\ \hline 7|02 \end{array} \quad \begin{array}{l} 4s. \frac{1}{2} 27..7..7 \\ \hline \text{Answer } 5..9..6 \end{array}$$

19. What is the brokage of £675..13..8. at 5s. per cent.?

Ans. £1..13..9½.

20. When a broker sells goods to the amount of £8453..17..5. what may he demand for brokage, if he is allowed 5s. 6d. per cent.?

Ans. £23..4..11½.

21. If a broker is employed to buy a quantity of goods, to the value of £1027..3..9. what is the brokage at 6s. 6d. per cent.?

Ans. £3..6..9.

When the time is $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$ of a year, besides a number of years given.

RULE. Take part of one year's int'rest, add them to The int'rest of a year, the answer's true.

22. What is the interest of £387..15.. for 4 months, at 5 per cent. per annum?

$$\begin{array}{r} 387..15 \\ 5 \\ \hline 19|38..15 \\ 20 \\ \hline 7|75 \\ 12 \\ \hline 9|00 \end{array}$$

4 $\frac{1}{4}$ 19..7..9

£6..9..3 *Answer.*

23. What is the interest of £556..7..6. for 3 years $\frac{1}{4}$, at 4 per cent. per annum?

$$\begin{array}{r} 556..7..6 \\ 4 \\ \hline 22|25..10.. \\ 20 \\ \hline 5|10 \\ 12 \\ \hline 1|20 \end{array} \quad \begin{array}{r} 22..5..1 \\ 3 \\ \hline 66..15..3 \\ 11..2..6\frac{1}{2} \\ 5..11..3\frac{1}{2} \\ \hline \text{Ans. } £83..9.. \frac{1}{2} \end{array}$$

24. What is the interest of £278..7..4. at 6 per cent. per annum, for one year and three quarters? *Ans.* £29..4..6½.

25. What is the interest of £476..17.. at 4 per cent. per annum, for four years and a half? *Ans.* £85..16..7½.

26. What is the interest of £365..5..9. for two years and three quarters, at 5 per cent. per annum? *Ans.* £50..4..5½.

27. What

60 Interest.

The New Tutor's

27. What is the interest of £256..18..4. at 4 per cent. per annum, for two years and a half? *Ans.* £35..13..9½.

When the rate per cent. is ½, ⅓, or ¼ more than the pounds given in the rate.

RULE. Proceed as in Commission.

28. What is the interest of £197..18..- for three years and a half, at 4½ per cent. per annum?

£ 197..18

4

791..12

98..19

890..11

20

£ 8..18..1½

3

26..14..3½

4..9..-½

£31..3..4½ *Answer*

18|12

12

1132

4

1128

29. What is the interest of £547..16..6. at 3½ per cent. per annum, for two years and three quarters?

Ans. £52..14..6.

30. What is the interest of £584..2..8. for six years and one quarter, at 4½ per cent. per annum? *Ans.* £164..5..8.

31. What is the interest of £256..15..6. at 5½ per cent. per annum, for four years and three quarters?

Ans. £64..-..7½.

When interest is required for any number of weeks.

RULE. Let one year's interest be multiply'd
By all the given weeks, and then divide
By fifty-two, the answer you'll provide.

32. What is the interest of £459..15..9. for 4 week, at 3½ per cent. per annum?

As

$$\frac{1}{2} \frac{1}{2} 459..15..9$$

$$\begin{array}{r} 1379..7..3 \\ 229..17..10\frac{1}{2} \end{array}$$

$$16|09..5..1\frac{1}{2} = £16..1..10$$

Or thus: multiply by the number of weeks, and divide the product by 4 and 13, being $4 \times 13 = 52$ $13|16..1..10$

$$1..4..9$$

N. B. As it is 4 weeks, don't multiply, but only divide by 13.

33. What is the interest of £657..4..8. for 20 weeks, at $4\frac{1}{2}$ per cent. per annum? Ans. £11..7..6.

34. What is the amount of £354..19..10. for 15 weeks, at $3\frac{1}{2}$ per cent. per annum? Ans. £358..11..6.

35. What is the amount of £331..2..9. for thirty-six weeks, at $4\frac{1}{2}$ per cent. per annum? Ans. £339..5..1 $\frac{1}{2}$.

When the interest is for any number of days.

RULE. The days and rate and principal in pence

Together multiply; cut off from thence

Two figures to the right; by days in the year

Divide that sum, the answer will appear.

36. What is the interest of £250. for 120 days, at 5 per cent. per annum?

$$250$$

$$240$$

$$60000$$

$$120$$

$$7200000$$

$$5$$

$$365|360000|00(9864$$

$$=£4..2..2\frac{1}{2}$$

Or thus.

$$250 \text{ As } 365 : 120 :: 120$$

$$5$$

$$12|50$$

$$20$$

$$10|00$$

$$365|30000(814$$

$$=£4..2..2\frac{1}{2}$$

37. What

62 Interest.

The New Tutor's

37. What is the interest of £279..6..8. for 3 years and 84 days, at 4 per cent. per annum? *Ans.* £36..1..9 $\frac{1}{2}$.
 38. At 5 $\frac{1}{2}$ per cent. per annum, what is the interest of £725..7..9. for 6 years, 92 days? *Ans.* £249..8..7 $\frac{1}{2}$.
 39. What is the interest of £3594..10..11. at 4 $\frac{1}{2}$ per cent. per annum, for 5 years, 142 days? *Ans.* £871..14..

When the amount, time, and rate per cent. are given to find the principal.

RULE. First let the giv'n amount be multiply'd
 By just an hundred, that product divide
 By the amount of a full hundred pound
 At rate and time propos'd, the answer's found.

40. What principal, being put to interest, will amount to £517..10.. in 5 years, at 3 per cent. per annum?

$$3 \times 5 + 100 = 115 : 100 :: 517.10 : £450$$

15	20
2300	10350
23100	1035000(450

41. What principal, being put to interest for 7 years, will amount to £352. at 4 per cent. per annum? *Ans.* £275.

42. What principal, being put to interest for 11 years, will amount to £553..7.. at 5 per cent. per annum? *Ans.* £357.

When the principal, rate per cent, and amount are given, to find the time.

RULE. If you the given interest divide
 By a year's interest, it will provide
 The time in years, by which you may abide.

43. In what time will £450. amount to £517..10.. at 3 per cent. per annum?

450	As 13..40 :: 67..10	517..10
3	20	20
13150	270	1350(5 years.
20		1350
20		67..10

ASSISTANT.

Interest. 163

44. In what time will £275. amount to £352. at 4 per cent. per annum? *Ans. 7 years.*

45. In what time will £357. amount to £553.7. at 5 per cent. per annum? *Ans. 11 years.*

When the principal, amount, and time, are given, to find the rate per cent.

RULE. The interest multiply of time propos'd
By just an hundred, and when so dispos'd,
By principal divide, that quote again
Divide by time, you'll find the rate remain.

46. At what rate per cent. will £450. amount to £517.10. in 5 years?

517.10 As 450 : 67.10 :: 100 : 15

450. — 60 —

20

67.10

1350

100

4510)135000(300. = 15 ÷ 5 = £3. per cent.

135

47. At what rate per cent. will £275. amount to £352. in 7 years? *Ans. 4 per cent.*

48. At what rate per cent. will £357. amount to £553. in 11 years? *Ans. 5 per cent.*

Compound INTEREST

IS that which arises both from the principal and interest; that is, when the interest on money becomes due, and not paid, the same interest is allowed on that interest unpaid, as was on the principal before.

RULE 1: Let first year's interest when found, added be
To principal, th' interest of that sum you see
Then find, which add, proceeding as before
Thro' all the years, until you have no more.

RULE 2: Subtract the given sum from last amount,
What's left, for compound interest you may count.

G

Wait

64 *Rebate or Discount.*

The New Tutor's

1. What is the compound interest of £500. forborne four years at 5 per cent. per annum?

500	500	525	551..5..
5	25	26..5	27..11..3
25100	525	1st year.	551..5 2d year.
5	5	5	578..16..3 3d year.
26125	27156..5	28194..1..3	
20	20	20	
5100	11125	18181	
	12	12	
578..16..3			
28..18..9½	3100	9175	
		4	
607..15..-¾	4 years amount.	100	
500			

107..15..-¾ interest for 4 years.

2. What is the amount of £400. forborne 3½ years at 4½ per cent. per annum, compound interest?

Ans. £466..14..8½.

3. What will £450. amount to in 5 years, at 5 per cent. per annum, compound interest?

Ans. £574..6..6.

4. What is the amount of £550. for three years and nine months, at 5 per cent. per annum, compound interest?

Ans. £660..11..4½.

5. What is the compound interest of £685. for 4 years and 6 months, at 6 per cent. per annum?

Ans. £205..14..9½.

6. What is the compound interest of £75..10..6. for 5 years, 8 months, and 22 days, at 5 per cent. per annum?

Ans. £24..7..6½.

7. What is the compound interest of £375..10..- for 3 years, 9 months, and 10 days, at 4½ per cent. per annum?

Ans. £68..10..11½.

REBATE or DISCOUNT

IS the abating so much money on a debt, to be received before it is due, as that money, if put to interest, would gain in the same time, and at the same rate. As £100. present money would discharge a debt of £105. to be paid a year to come, rebate being made at 5 per cent.

RULE. An hundred pound with its true int'rest take
At time propos'd, and a divisor make,
The giv'n sum by th' int'rest multiply'd,
Will for the same a dividend provide,
Th' proper quotient rising thence will be
The true rebate requir'd we all agree,
Which take from giv'n sum, th' present worth you'll see.

EXAMPLES.

1. What is the discount and present worth of £576..15..6.
for 6 months, at 6 per cent. per annum?

$$\begin{array}{r} 6m. \frac{1}{2} 6 \\ \hline \end{array} \quad \begin{array}{r} \text{As } 103 \\ 20 \end{array} : 3 :: 576..15..6$$

$$\begin{array}{r} 3 \\ \hline 100 \end{array} \quad \begin{array}{r} 2060 \\ 12 \end{array} \quad \begin{array}{r} 11535 \\ 12 \end{array}$$

$$\begin{array}{r} 103 \\ \hline 247210 \end{array} \quad \begin{array}{r} 138426 \end{array}$$

$$\begin{array}{r} 576..15..6 \\ 16..15..11\frac{1}{2} \end{array} \quad \begin{array}{r} \text{discount.} \end{array}$$

$$4152718 \quad \begin{array}{r} 16..15..11\frac{1}{2} \end{array}$$

559..19.. 6 $\frac{1}{2}$ present worth.

2. What is the present payment of £457..10..- which
was agreed to be paid 9 months hence, at 5 per cent. per
annum?

$$\text{Ans. } £441..8..1\frac{1}{2}$$

3. What is the discount of £545..10..- for 7 months, at
5 per cent. per annum?

$$\text{Ans. } £15..9..8$$

4. Bought goods to the value of £257..10..- to be paid
at 9 months, what present money will discharge the same if I
am allowed 6 per cent. per annum, discount?

$$\text{Ans. } £246..8..3$$

5. What is the present worth of £345..10..6 payable 9
months hence, at $4\frac{1}{2}$ per cent. per annum?

$$\text{Ans. } £334..4..10\frac{1}{2}$$

6. Sold goods for £1005..7..6. to be paid 7 months hence,
at $4\frac{1}{2}$ per cent. per annum, what is the present worth?

$$\text{Ans. } £981..12..1$$

7. What is the discount of £79..15..- due October 5,
this being May 28, rebate at 5 per cent. per annum?

$$\text{Ans. } £1..7..10\frac{1}{2}$$

8. What is the present worth of £700. payable 10 months
hence, rebate at 5 per cent. per annum?

$$\text{Ans. } £672$$

9. How much ready money can I receive for a note of
£85. due 16 months hence, rebate at 4 per cent. per annum?

$$\text{Ans. } £80..13..1\frac{1}{2}$$

66 Equation of Payments. The First Tutor's

10. What will be the present worth of £40. payable at 3 four months, i.e. one third at four months, one third at 8 months, and one third at 12 months, allowing 5 per cent. discount? *Ans.* £32.6..—.

11. Sold goods to the value of £175. 10. to be paid at 2 three months, what must be discounted for present payment, at 5 per cent.? *Ans.* £8. 14. 7½.

12. What is the present worth of £600. at 4 per cent. £100. being to be paid down, and the rest at 2 six months? *Ans.* £585. 9. 8½.

EQUATION of PAYMENTS

IS when several sums are due at different times, to find a mean time for paying the whole debt; to do which this is the common

RULE. Let each sum by its time be multiply'd
By the whole debt, the sum of them divide,
The quotient will the true mean time provide.

EXAMPLES.

1. A owes B £400. whereof £80. is to be paid at 3 months, £120. at 5 months, and £200. at 10 months; at what time may the whole debt be paid together, without prejudice to either?

$$80 \times 3 = 240$$

$$120 \times 5 = 600$$

$$200 \times 10 = 2000$$

$$400 \quad) 2840$$

$$7.10$$

$$7m.40 = 7\frac{2}{3}$$

$$Ans. 7m.40 = 7\frac{2}{3}$$

2. B owes C £1200. whereof £300. is to be paid at 3 months, £150. at 4 months, £450. at 5 months, and £300. at 6 months; but they agreeing to make but one payment of the whole, I demand what time that must be?

$$Ans. 4 months, 18 days.$$

3. H bought of I a quantity of goods, to the value of £540. which was to have been paid as follows, £180. at 2 months, £300. at 4 months, and the rest at 5 months, but they afterward agreed to have it paid at one mean time, that time is demanded?

$$Ans. 3 months, 13 days.$$

4. A merchant bought goods to the amount of £750. to pay £150. at the end of 4 months, £225. at the end of 6 months, and £375. at the end of 12 months; but afterwards they agreed to discharge the debt at one payment; at what time was this payment made? *Ans.* 8 months, 18 days.

5. I is indebted to K a certain sum, which is to be paid at 6 different payments, that is, $\frac{1}{2}$ at two months, $\frac{1}{4}$ at three months, $\frac{1}{8}$ at four months, $\frac{1}{16}$ at five months, $\frac{1}{32}$ at six months, and the rest at seven months, but they agree that the whole shall be paid at one equated time; that time is required?

Ans. 4 months, 1 quarter.

6. L is indebted to M £180. whereof $\frac{1}{2}$ is to be paid at three months, $\frac{1}{4}$ at six months, the rest at nine months; what is the equated time of the whole payments?

Ans. 5 months, 7 days.

B A R T E R

IS the exchanging one commodity for another; and informs the traders so to proportion their goods that neither may sustain loss.

RULE 1. The value of the given quantum find,
And then how much of t^other quantum mind
May for the former value purchas'd be,
At rate propos'd, and you'll the answer see.

2. In Barter when one rates his goods at more
Than was the price in ready cash before,
Find how the last (by what the first has done)
Should rate his goods, then as before go on.

E X A M P L E S.

1. What quantity of chocolate, at 5s. per lb. must be delivered in barter for 3 cwt. of tea, at 10s. per lb.?

112

3

336

10

5)3360 value of the tea.

672 lb. of chocolate.

2. B and C barter; B hath 30 cwt. of prunes, at 4s. per lb. ready money, but in barter will have 5s. per lb. and C hath hops worth 32s. per cwt. ready money, what ought C to rate his hops at in barter, and what quantity must be given for the 30 cwt. of prunes?

As 4 : 5 :: 32

112

5

30

4)160

3360

5

40s.

12

1680

144

48

240

Ans. 40s. and 35 cwt. of hops.

3. How much tea, at 9s. 6d. per lb. can I have in barter for 5 cwt. 2 qrs. of chocolate, at 5s. per lb.?

Ans. 324 lb. $\frac{24}{11}$.

4. Two merchants barter; C hath 30 cwt. of cheese, at 25s. 6d. per cwt. D hath 12 pieces of cloth, at £3. 14s. per piece; I desire to know who must receive the difference, and how much?

Ans. D £4. 19s. —.

5. D and E barter; D hath 6½ lb. of pepper, at 13d. ½ per lb. E hath ginger at 15d. ½ per lb. how much ginger must be delivered in barter for the pepper?

Ans. 5 lb. $\frac{46}{11}$.

6. How many dozen of candles, at 7s. 4d. per dozen, must be delivered in barter for 5 cwt. 3 qrs. 18 lb. of tallow, at 37s. 8d. per cwt.

Ans. 30 doz. 4 lb.

7. E hath 912 yards of cloth, worth 14s. per yard, for which F giveth him £188. 8s. —. in ready money, and 128 cwt. 2 qrs. 8 lb. of bees-wax. The question is, what did F reckon his bees-wax at per cwt.?

Ans. £3. 10s. —.

8. C hath 230 dozen of candles, at 6s. 8d. per dozen, for which D giveth him £20. in money, and the rest in cotton, at 8d. per lb. I desire to know how much cotton D gave C besides the money?

Ans. 1700 lb.

9. If E hath cotton at 11s. 3d. per lb. how much must he give C for 127 lb. of tobacco at 6d. per lb.?

Ans. 50 lb. $\frac{12}{11}$.

10. D hath nutmegs worth 8s. 6d. per lb. ready money, but in barter will have 9s. per lb. and E hath leaf tobacco worth 10d. per lb. ready money, how much must E rate his tobacco at per lb. that his profit may be equivalent to D's?

Ans. 10d. $\frac{12}{11}$.

PROFIT and LOSS

IS a rule that discovers what is got or lost in the buying and selling of goods; and instructs us to rise or fall the price, so as to gain or lose so much per cent. or otherwise.

N. B. The questions in this rule are performed by the Rule of Three.

EXAMPLES.

- | | |
|--|--|
| 1. If 1 yard of cloth cost 11s. and is sold for 12s. 8d. what is the gain per cent.? | 2. If 120 ells of holland cost £36. what must 1 ell be sold for to gain 8 per cent.? |
|--|--|

12..8 As 11 : 1..8 :: 100

11..- 12 20

1..8 20 2000

20

11)40000

12)3636

2)0)30)3

£15..3

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

As 100 : 36 :: 108

36

648

324

100)38|88

120

12)38..17..7

17|60

12

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

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10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

12)38..17..7

10)3..4..9

3. If a pound of tobacco is bought for 18d. and sold for 21s. what is the rate per cent.?

Ans. £33..6..8.

4. If a parcel of goods be sold for £640. and 12 per cent. profit, what was the prime cost?

Ans. £571..18..6 $\frac{1}{2}$. 48 rem.

5. If a yard of cloth is bought for 16s. 8d. and sold again for 20s. what is the gain per cent.?

Ans. £20.

6. If 112 lb. of iron cost 27s. 6d. what must 1 cwt. be sold for to gain £15. per cent.?

Ans. £1..12..7 $\frac{1}{2}$.

7. If 255 yards of broad cloth be sold for £275. and 20 per cent. profit, what did it cost per yard?

Ans. 17s. 11d. $\frac{1}{2}$.

8. Sold 1 cwt. of hops for £7..15..- at the rate of 25 per cent. profit, what would have been the gain per cent. if I had sold them for £8..8..- per cwt.?

Ans. £27..1..11.

9. If 100 ells of cambric cost £75. how must I sell it per yard to gain 20 per cent.?

Ans. 14s. 4d. $\frac{1}{2}$.

10. A plumber sold 10 fother of lead for £204..15..- (the fother being 19 cwt. $\frac{1}{2}$) and gained after the rate of 12 and a half per cent. what did it cost him per cwt.?

Ans. 18s. 8d.

11. Bought 357 yards of cloth, at 7s. 9d. per yard, and sold it for 10s. per yard, what was the gain of the whole?

Ans. £40..3..3.

12. Paid £54. for one ton of steel, which is retailed at 6d. per lb. what is the profit or loss by the sale of 12 tons?

Ans. £34. gain.

13. Bought 156 yards of linen for £40. how should the same be sold to gain 15 per cent.?

Ans. 5s. 10d. $\frac{1}{2}$ per yard.

14. Bought 375 yards of cloth, at 3s. 8d. per yard, and retailed the same at 4s. 7d. per yard, what is the profit in the whole, and how much per cent.?

Ans. £17..3..9. whole, £25. per cent.

F E L L O W S H I P

If when two or more join their stock and trade together, so to determine each person's particular share of the gain or loss, in proportion to his principal in the joint stock.

By this rule a bankrupt's estate may be divided among his creditors; as also legacies may be adjusted when there is a deficiency of assets or effects.

FELLOWSHIP is either with or without TIME.

FELLOWSHIP without TIME.

RULE. For a first term the whole stock take;
The gain or loss the second make;
Then any stock the third you'll see:
Whichever its gain or loss should be.

PROOF. As the total gain or loss
Is to the whole stock,
Each man's share of gain or loss
To each share in stock.

1. Two merchants trade together; A put into stock £30. and B £50. they gained £60. what is each person's share thereof?

$$\begin{array}{rcl}
 30 + 50 = 80 & & \\
 \text{As } 80 :: 60 :: 30 & \text{As } 80 :: 60 :: 50 & \\
 \hline
 22.10 & 37.10 & \text{B's share.} \\
 30 & 50 & \hline
 80 & 80 & \text{A's share.} \\
 \hline
 180 & 300 & \\
 180 & 300 & \hline
 60 & 60 & \text{whole gain.} \\
 \hline
 22.10 & 37.10 &
 \end{array}$$

2. Three persons trade together, B, C, and D; B put in £30. C £45. and D £60. they gained £70. what is each man's part of the gain? *Ans.* B £60. C £90. D £120.

3. D, E, and F enter into partnership; D puts in £375. E £485. and F £500. and they gained £864. what is each man's share in proportion to his stock?

$$\begin{array}{rcl}
 \text{Ans. D } 338.4.8 & 1200. & \text{E } 308.2.4 & 1280. \\
 \text{F } 317.12.11 & 240. & &
 \end{array}$$

4. Four

4. Four persons, D, E, R, and G, made a stock; D put in £340..10..—, E £523..10..—, F £174..10..—, and G £688..10..—, in trading they gained £642. I demand each person's share of the gain?

Ans. D £126..14..6—7200. E £194..16..7 $\frac{1}{2}$ —24900.
F £64..4..— G £256..4..4..10—2400.

5. Three merchants, F, G, and H, join company; F's stock was £1125, G's £690, and H's £750, and at the end of 12 months, they gained £1026. what is each man's particular share of the gain?

Ans. F £450. G £276. H £300.

6. A merchant is indebted to A £413..11..—, to B £456..10..—, to C £228, and to D £156..9..—, but upon his decease, his estate is found to be worth but £1013..12..—, how must it be divided among his creditors?

Ans. A £334..2..8 $\frac{1}{2}$ —1786. B £368..16..9 $\frac{1}{2}$ —8630.
C £184..4..4—19040. D £126..8..1 $\frac{1}{2}$ —20724.

7. Four persons trading together in a joint stock, of which B has $\frac{1}{3}$, C $\frac{1}{4}$, D $\frac{1}{5}$, and E $\frac{1}{6}$, and at the end of 6 months they gained £150. what is each man's share of the said gain?

Ans. B £52..12..7 $\frac{1}{2}$ —7200. C £39..9..5 $\frac{1}{2}$ —16800.
D £31..11..6 $\frac{1}{2}$ —18000. and E £26..6..3 $\frac{1}{2}$ —3600.

8. Two persons purchased an estate of £1500. per annum freehold for £25200. when money was at 6 per cent. interest, and 4s. in the pound land-tax, whereof B paid £15000. and C the rest; sometime after the interest of money falling to 5 per cent. and 2s. per pound land-tax, they sell the said estate for 24 years purchase; I desire to know each person's share?

Ans. B £11428..11..5—1440. C £14571..8..6 $\frac{1}{2}$ —10800.

9. A, B, and C, join stocks in trade; the amount of their stocks is £970..10..—, and are in proportion as 4, 6, and 8, are to one another, and the amount of the gain is equal to A's stock; what is each man's stock and gain?

Ans. A's stock, £215..13..4 gain, £47..18..6 207040

B's - - 323..10..— 71..17..9 $\frac{1}{2}$ 77640

C's - - 431..6..8 95..17..9 $\frac{1}{2}$ 181160

10. D, E, and F, join stocks in trade; the amount of their stocks was £200. D's gain £6, E's £10, and F's £16, what was each man's stock?

Ans. D's stock £37..10..— E's £62..10..— F's £100.

FELLOWSHIP with TIME.

RULES. Let each man's time and cash be multiply'd,
The product take, and by last rule abide.

PROOF. As in Fellowship without Time.

72 Fellowship.

The New Tutor's

EXAMPLES.

1. B and C enter partnership; B puts in £60. for three months, and C £12. for four months, and they gained £105. what is each man's share of the gain?

$$60 \times 3 = 180 \quad A: 628: 105 :: 180 \quad A: 628: 105 :: 448$$

$$12 \times 4 = 48 \quad 180 \quad 105$$

$$628 \quad 628) 18900(30$$

$$18864$$

$$2240$$

$$448$$

$$628) 47040(74$$

$$4396$$

$$30 \quad 60 \text{ rem. } B$$

$$74 \quad 568 \quad C$$

$$3680$$

$$2512$$

$$105 \text{ proof.} \quad 568$$

2. Three merchants join in company; A puts in stock £178..16.. for 3 months; B £154..15..6. for 5 months; and C £75..10..6. for 10 months; they gained £472..18.. what is each man's part of the gain?

$$Ans. A £122..16..1 \frac{1}{2} - 467454. B £177..3..6 \frac{1}{2} - 412980.$$

$$and C £172..18..3 \frac{1}{2} - 121018.$$

3. Three merchants join in company for 18 months; D put in £750. and at 5 months end took out £300. at 10 months end puts in £450. and at the end of 14 months takes out £160. E puts in £600. and at the end of 3 months £540. more; at nine months he takes out £180. but puts in £200. at the end of 12 months, and withdraws £100. at the end of 14 months. F puts in £900. and at 6 months took out £200. at the end of 11 months put in £500. but takes out that and £100. more at the end of 13 months. They gained £300. I desire to know each man's share of the gain?

$$Ans. £85..7..3 \frac{1}{2} - 7140. B £114..5..5 \frac{1}{2} - 19260.$$

$$C £100..7..5 \frac{1}{2} - 16340.$$

4. A, B, and C, hold a piece of ground in common, for which they are to pay £42..5.. A puts in 23 oxen for 27 days; B 21 oxen 35 days; and C 16 oxen 28 days; what is each man to pay of the said rent?

$$Ans. A £14..10..10 \frac{1}{2} - 312. B £17..4..3 \frac{1}{2} - 500.$$

$$C £10..9..10 - 992.$$

ALLIGATION.

ALLIGATION.

ALLIGATION is either MEDIAL or ALTERNATE.

ALLIGATION MEDIAL

IS when the price and quantities of several simples are given to be mixed, to find the mean price of that mixture.

RULE. The whole composite for a first term take,
Its total value then a second make,
Then any part the third; the fourth will be
The true mean rate, when work'd by Rule of Three.

PROOF. What is the worth of the whole mixture see
At the mean rate, and if it does agree
With the whole worth the given quantum, shew
At their respective rates, the work is true.

1. A farmer mixed 18 bushels of wheat at 4s. per bushel, and 34 bushels of rye at 3s. per bushel, with 42 bushels of barley at 2s. per bushel. I desire to know the worth of a bushel of this mixture?

$$18 \times 4 = 72$$

$$34 \times 3 = 102$$

$$42 \times 2 = 84$$

$$\hline 94 \quad 258$$

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2. A grocer mingled 3 cwt. of sugar at 58s. per cwt. 6 cwt. at 42s. per cwt. and 7 cwt. at 39s. per cwt. I demand the price of 2 cwt. of this mixture?

$$\text{Ans. } 64.7.14\frac{1}{2}$$

$$\text{H } 3. A$$

3. A vintner mingles 14 gallons of Canary at 8s. 4d. per gallon, with 20 gallons at 7s. 6d. per gallon, 8 gallons of sherry at 7s. 4d. per gallon, and 22 gallons of white wine at 4s. 6d. per gallon. What is the worth of a gallon of this mixture?

Ans. 6s. 7d. $\frac{1}{2}$.

4. A malster mingles 25 quarters of brown malt at 27s. per quarter, with 45 quarters of pale, at 32s. per quarter, and 27 quarters of high dried ditto, at 25s. per quarter, what is the value of 8 bushels of this mixture?

Ans. £1..8..9 $\frac{1}{2}$.

5. If I mix 25 bushels of wheat, at 5s. 9d. per bushel, with the same quantity of rye, at 4s. 3d. per bushel, and 16 bushels of barley at 2s. 10d. per bushel, what is the worth of a bushel of this mixture?

Ans. 4s. 5d. $\frac{1}{2}$.

6. A grocer mingled 2 cwt. of sugar, at 58s. per cwt. 7 cwt. at £1..17..6. per cwt. and 4 cwt. at £4..11..4. per cwt. what is 1 cwt. of this mixture worth?

Ans. £2..18..2 $\frac{1}{2}$.

7. A mealman has flour of several sorts, and would mix 5 bushels at 3s. 7d. per bushel, 4 bushels at 4s. 9d. per bushel, and 7 bushels at 5s. 6d. per bushel, what is the worth of a bushel of this mixture?

Ans. 4s. 8d. $\frac{1}{2}$.

8. A vintner mixes 20 gallons of Port, at 5s. 3d. per gallon, with 14 gallons of white wine, at 4s. 10d. per gallon, 34 gallons of Lisbon, at 5s. 6d. per gallon, and 25 gallons of mountain, at 6s. per gallon, what is a gallon of this mixture worth?

Ans. 5s. 5d. $\frac{1}{2}$.

9. A farmer mingled 15 bushels of wheat, at 5s. 6d. per bushel, and 37 bushels of rye, at 2s. 6d. per bushel, with 45 bushels of barley, at 2s. 9d. per bushel. I desire to know the worth of a bushel of this mixture?

Ans. 3s. 1d.

10. A person mixing a quantity of oats, at 2s. 8d. per bushel, with the like quantity of beans, at 4s. 6d. per bushel, would be glad to know the price of one bushel of this mixture?

Ans. 3s. 7d.

11. A refiner having 10 lb. of silver bullion, of 6 oz. fine, would melt it with 7 lb. of 7 oz. fine, and 12 lb. of 8 oz. fine, required the fineness of 1 lb. of that mixture?

Ans. 7 oz. 1 dwt.

12. If with 40 bushels of corn, at 3s. per bushel, there are mixed 8 bushels, at 6s. per bushel, 25 bushels, at 5s. per bushel, and 18 bushels, at 4s. per bushel, what will 10 bushels of that mixture be worth?

Ans. £2..2..2 $\frac{1}{2}$.

13. A

13. A tobacconist would mix 40 lb. of tobacco, at 11d. per lb. with 35 lb. at 14d. per lb. 24 lb. at 22d. per lb. and 35 lb. at 2s. per lb. What will 1 lb. of this mixture be worth?
Ans. 17d.

ALLIGATION ALTERNATE

Is when the prices of several things are given, to find such quantities of them to make a mixture, that may bear a price propounded.

When the prices of the several simples and the mean rate are given without any quantity, to find how much of each simple is required to compose the mixture.

RULE. Under each other let the prices stand.

The price propounded put at the left hand;

Then link the prices two and two, but mind

A greater with a less be always join'd.

'Gainst each price place th' difference between

Its own yokefellow and propounded mean.

The difference and the mean rate take

Placed alternate, will th' answer make.

PROOF. By Alligation Medial.

EXAMPLES.

1. A vintner would mix four sorts of wine together, of 18d. 20d. 24d. and 26d. per quart, what quantity of each must he take to sell the mixture at 22d. per quart?

<i>Answer.</i>	<i>Proof.</i>	<i>Or thus.</i>	<i>Proof.</i>
18 — 2 of 18 = 36	18 — 4 of 18 = 72		
20 — 4 of 20 = 80	20 — 2 of 20 = 40		
24 — 4 of 24 = 96	24 — 2 of 24 = 48		
26 — 2 of 26 = 52	26 — 4 of 26 = 104		
12 —)264	12 —)264		
22d. = 81 12	22d. = 81 12		

Note. Questions in this rule admit of a great variety of answers, according to the manner of linking them.

2. A grocer would mix sugar, at 4d. 6d. and 10d. per lb. so as to sell the compound at 8d. per lb. what quantity of each must he take?
Ans. 2 of 4, 2 of 6, 2 of 10.

3. I desire to know how much tea, at 16s. 14s. 8s. and 9s. per lb. will compose a mixture worth 10s. per lb.?

Ans. 2 at 16s. 1 at 14s. 6 at 8s. 4 at 9s.

Et 2 4. A

76 *Alternation Partial.* *The New Tutor's*

4. A farmer would mix as much barley at 3s. 6d. per bushel, rye at 4s. 2d. per bushel, and oats at 20d. per bushel, as to make a mixture worth 2s. 6d. per bushel. How much is that of each sort? *Ans.* 10 at 3s. 6d. 10 at 4s. 2d. 32 at 20d.

5. A grocer would mix raisins of the sun at 9d. per lb. with Malaga's at 7d. and Smyrna's at 6d. I desire to know what quantity of each sort he must take to sell them at 8d. per lb.? *Ans.* 2 at 9d. 2 at 7d. 2 at 6d.

6. A tobaccoist would mix tobacco at 2s. 20d. and 1s. 3d. per lb. so as the compound might bear a price of 1s. 6d. per lb. what quantity of each sort must he take? *Ans.* 3 at 2s. 3 at 20d. 8 at 15d.

ALTERNATION PARTIAL

IS when the prices of all the simples, the quantity of but one of them, and the mean rate are given, to find the several quantities of the rest in proportion to that given.

RULE. Just as you did before, each difference take,
And of that difference a first term make
Whose quantum's given, let the second be
In its due turn, each difference you see;
The given quantum third, if you work true,
The quantities requir'd will rise to view.

EXAMPLES.

1. A tobaccoist being determined to mix 25 lb. of tobacco, at 14d. per lb. with others at 16d. 18d. and 22d. per lb. how many pounds of each sort must he take to make 1lb. of that mixture worth 17d.?

	<i>Answer.</i>	<i>Proof.</i>	
14	1 25 lb. at 14 = 350d.	As 1 : 5 :: 25 : 125	
16	5 125 lb. at 16 = 2000d.	As 1 : 3 :: 25 : 75	
18	3 75 lb. at 18 = 1350d.	As 1 : 1 :: 25 : 25	
22	1 25 lb. at 22 = 550d.		

$$250 \quad 4250 :: 1 \text{ lb.} : 17d.$$

8. A farmer would mix 20 bushels of wheat at 60d. the bushel, with rye at 36d. barley at 24d. and oats at 18d. per bushel. How much must he take of each sort to make the composition worth 32d. per bushel?

Ans. 20 bushels of wheat, 35 bushels of rye, 70 bushels of barley, and 10 bushels of oats.

9. A person is desirous of mixing wheat at 4s. the bushel, rye at 3s. per bushel, and barley at 2s. per bushel, with 12 bushels of oats at 8d. per bushel. I should be glad to know how many bushels of each sort he must take to make the composition worth 3s. 6d. per bushel?

Ans. 96 wheat, 12 rye, 12 barley, 12 oats.

10. A distiller would mix 36 gallons of French brandy, at 14s. per gallon, with English at 9s. and spirits at 5s. per gallon. What quantity of each sort must he take to afford it for 8s. per gallon?

Ans. 36 French brandy, 36 English, 84 spirits.

11. A grocer would mix teas of 14s. 12s. and 10s. with 24 lb. of 6s. How much of each sort must he take to make the composition worth 8s. the lb.?

Ans. 4 at 14s. 4 at 12s. 4 at 10s. and 24 at 6s.

12. A wine-merchant is desirous of mixing 20 gallons of Canary, at 6s. 8d. per gallon, with Malaga at 7s. 6d. per gallon; sherry, at 5s. per gallon, and Lisbon, at 4s. 2d. per gallon. How much of each sort must he take, that the mixture may be sold for 5s. 10d. per gallon?

Ans. 20 at 6s. 8d. 40 at 7s. 6d. 20 at 5s. and 40 at 4s. 2d.

ALTERNATION TOTAL

Is when the price of each simple, the quantity to be compounded, and the mean rate, are given to find how much of each sort will make that quantity.

RULE. Just as you did before, each difference take,
And the sum of all a first term make;
Each difference a second term should be,
The given quantum third, and then you'll see
The quantity requir'd by Rule of Three. }

EXAMPLES.

13. A grocer has four sorts of sugar, viz. 14d. 12d. 8d. and 6d. per lb. and would make a composition of 156 lb. worth 9d. per lb. I desire to know what quantity of each he must take?

H. 9

Answer.

	<i>Answer.</i>	<i>Proof.</i>
14	1 -- 13 at 14d. 182	As 12 : 1 :: 156 : 13
9	3 -- 39 at 12d. 468	As 12 : 3 :: 156 : 39
8	5 -- 65 at 8d. 520	As 12 : 5 :: 156 : 65
6	9 -- 39 at 6d. 234	As 12 : 3 :: 156 : 39
	12 156	) 1404 (9d.

14. A druggist having 4 sorts of teas, of 5s. 6s. 9s. and 10s. per lb. would have a composition of 96 lb. worth 7s. the lb. what quantity must there be of each?

Ans. 12 at 10s. 12 at 9s. 24 at 6s. 36 at 5s.

15. A vintner hath four sorts of wine, viz. Lisbon, at 4s. per gallon; Flemish, at 6s. per gallon; Malaga, at 8s. per gallon; and Canary, at 10s. per gallon; would make a mixture of 60 gallons, to be worth 5s. per gallon. What quantity of each sort must he take?

Ans. 5 at 10s. 5 at 8s. 5 at 6s. 45 at 4s.

16. A grocer having four sorts of currants, of 11d. 9d. 6d. and 4d. the poundy is desirous of making a composition of 260 lb. worth 8d. the lb. How much of each sort must he take?

Ans. 104 at 11d. 52 at 9d. 26 at 6d. 78 at 4d.

17. A silversmith hath four sorts of gold, of 24 carats fine, of 22, 20, and 15 carats fine, would mix as much of each sort together, so as to have 63 oz. of 17 carats fine. How much must he take of each?

Ans. 6 at 24 car. 6 at 22 car. 6 at 20 car. 45 at 15 car.

18. A druggist having some drags of 8s. 5s. and 4s. per lb. made them into two parcels; one of 28 lb. at 7s. per lb. the other of 48 lb. at 6s. per lb. How much of every sort did he take for each parcel?

Ans. 12 at 8s. 8 at 5s. 8 at 4s. Second 30 at 8s.

6 at 5s. and 6 at 4s.

POSITION, or the RULE OF FALSE

IS a rule that, by false or supposed numbers, taken at pleasure, discovers the true. It is divided into two parts, SINGLE and DOUBLE.

SINGLE POSITION

Is by using one supposed number, and working with it as the true one, you find the real number required, by the following

RULE. For a first term, the total errors take,
And then the total true a second make;
The suppos'd number third, and then 'twill be
A simple question in the Rule of Three.

EXAMPLES.

1. A schoolmaster being asked how many scholars he had, said, if I had as many, half as many, and one quarter as many more, I should have 99. How many had he? *Ans.* 36.

Suppose he had - 48	As 132 : 99 :: 48	36
as many - - 48	48	36
half as many 24		18
$\frac{1}{4}$ as many - - 12	792	9
	396	
132		99 <i>proof.</i>
	132)4752(36	
	396	
	792	
	792	

2. A person having about him a certain number of Portugal pieces, said, if the third, fourth, and sixth of them were added together, they would make 63. I desire to know how many he had? *Ans.* 84.

3. A gentleman bought a chaise, horse, and harness, for £60. the horse came to twice the price of the harness, and the chaise to double the price of the horse and harness. What did he give for each?

Ans. £13..6..8. horse. £6..13..4. harness. £40. chaise.

4. B, C, and D, being determined to buy a quantity of goods, which would cost them £180. agreed among themselves

80 Position, or the Rule of False. The PETIT TUTOR'S

selves that C should have a third part more than B, and D a fourth part more than C. I desire to know what each man must pay? *Ans.* B £45. C £60. D £75.

5. A man overtaking a maid driving a flock of geese, said to her, How do you do, sweetheart; where are you going with these 30 geese? No, Sir, said she, I have not 30; but if I had as many more, half as many more, and 5 geese beside, I should have 30. How many had she? *Ans.* 10.

6. A person delivered to another a sum of money unknown, to receive interest for the same at 6 per cent. per annum, simple interest, and at the end of 10 years received for principal and interest £450. What was the sum lent?

Ans. £281.5..

DOUBLE POSITION

Is making use of two supposed numbers, and if both prove false, (as it generally happens) they are with their errors to be thus ordered.

RULE. Each error 'gainst its own position place,
Then multiply them cross-wise, and in case
The errors are alike, their diff'rence take
For a divisor.—A dividend then make
The diff'rence of their products.—If you see
Them unlike, let the sum of products be
A dividend; for a divisor use
Their sum. Both ways, the quotient the answer shews.

EXAMPLES.

1. B, C, and D, would divide £300. between them, so that C may have £8. more than B, and D £12. more than C. How much must each have?

Suppose B had 48
then C had 56
and D - - 68

Then suppose B had 54
then C had - - 62
and D - - - 74

172, 100 little by 128

190, 100 little by 110

Sup. errors.

48 X 128
54 X 110

128
110

18) 1632 (90 1/2
162

B 90..13..4
C 98..13..4
D 110..13..4

6912 5280

18 divisor.

12

Proof, £300.. -..

1632

2. A

ASSISTANT. *Position, or the Rule of False.* 81

2. A man had two silver cups, of unequal weight, having one cover to both of 5 oz. now if the cover is put on the lesser cup, it will double the weight of the greater cup; and if put on the greater cup, it will be thrice as heavy as the lesser cup. What is the weight of each cup?

Ans. 3 ounces less; 4 ounces greater.

3. B, C, and D, playing at hazard together, the money staked was 392 guineas; but disagreeing, each seized as many as he could, B got a certain quantity, C as many as B, and 32 more, and D the sixth part of both their sums. How many had each?

Ans. B 152, C 184, and D 56.

4. A gentleman bought a house, with a garden, and a horse in the stable, for £750. now he paid four times the price of the horse for the garden, and five times the price of the garden for the house. What was the price of the horse, garden, and house, separately?

Ans. horse £30, garden £120, house £600.

5. Three persons discoursed concerning their ages; says A I am 30 years of age; says B, I am as old as A, and $\frac{1}{4}$ of C; and says C, I am as old as you both. What was the age of each person?

Ans. A 30, B 50, and C 80.

6. D, E, and F, playing at cards, staked 486 guineas; but disputing about the tricks, each took as many as he could; D got a certain number; E as many as D, and 30 more; and F got a fifth part of both their sums added together. How many did each get?

Ans. D $187\frac{1}{2}$, E $217\frac{1}{2}$, F 81.

7. A stealing apples, was taken by B, and to appease him, gave him half he had, and B gives him back 10; going further he meets C, who took from him half he had left, and gives him back 4; after that meeting with D, he gives him half of what he had, and returns him back 1; at last getting safe away, he finds he had 13 left. How many had he at first?

Ans. 60.

8. A gentleman coming into a garden, meets with some ladies, says to them, Good-morning to you 10 fair maids. Sir, you mistake, (answered one of them) we are not 10, but if we were twice as many more as we are, we should be as many above 10 as we are now under. How many were they?

Ans. 5.

EXCHANGE

E X C H A N G E

IS the receiving of money in one country for the same value paid in another.

The Par of Exchange is always fixed and certain, it being the intrinsic value of foreign money compared with sterling, but the Course of Exchange rises and falls upon various occasions.

I. F R A N C E.

They keep their accounts at Paris, Lyons, and Rouen, in livres, sols, and deniers, and exchange by the crown, = 4s. 6d. at par.

NOTE. 12 deniers make 1 sol.

20 sols - - - 1 livre.

3 livres - - - 1 crown.

To exchange foreign money into sterling.

RULE. That foreign piece by which they do exchange.

Take first; its worth in pence you'll next arrange.

The given sum place third, and then you'll see.

The answer may be found by Rule of Three.

To change sterling into foreign.

RULE. For a first term, the worth of that piece take,

By which exchange is made—a second make

The piece—the sum the third must be,

And then the answer in the fourth you'll see.

E X A M P L E S.

1. How many crowns must be paid at Paris, to receive in London £360. exchange at 4s. 6d. per crown?

As 54 : 1 :: 360

20

7200

12

54) 86400 (1600

54

324

324

2. A merchant at Paris remits to his correspondent in London 1600 crowns, at 4s. 6d. each; what is the value in sterling?

As 1 : 54 :: 1600

54

12) 86400

54) 7200

£360

E X C H A N G E

ASSISTANT.

Exchange. 83

3. How much sterling must be paid in London, to receive in Paris 856 crowns, exchange at 56d. per crown?

Ans. £199..14..8.

4. A merchant in London remits £199..14..8. to his correspondent at Paris; what is the value in French crowns, at 56d. per crown?

Ans. 856.

5. Change 750 crowns, 17 sols, 6 deniers, at 54d. $\frac{1}{2}$ per crown, into sterling; what is the sum?

Ans. £170..7..6 $\frac{1}{2}$ $\frac{9}{16}$.

6. Change £170..7..6 $\frac{1}{2}$ $\frac{9}{16}$ into French crowns, exchange at 54d. $\frac{1}{2}$ per crown?

Ans. 750 crowns, 17 sols, 6 deniers.

II. S P A I N.

They keep accounts at Madrid, Cadiz, and Seville, in dollars, rials, and maravedies, at exchange by the piece of eight = 4s. 6d. at par.

NOTE. 34 maravedies make 1 rial.

8 rials - - - 1 piastre, or piece of eight.

10 rials - - - 1 dollar.

RULE. As with France.

EXAMPLES.

7. A merchant at Cadiz remits to London 2654 pieces of eight, at 56d. per piece; how much sterling is the sum?

Ans. £619..5..4.

8. How many pieces of eight, at 56d. each, will answer a bill of £619..5..4?

Ans. £2654.

9. If I pay a bill here of £2800. what Spanish money may I draw my bill for at Madrid, exchange at 58 $\frac{1}{2}$ per piece of eight?

Ans. 11487 pieces of eight, 1 rial, 14 maravedies.

III. I T A L Y.

They keep their accounts at Genoa and Leghorn in livres, sols, and deniers, and exchange by the piece of eight, or dollar, = 4s. 6d. at par.

NOTE. 12 deniers make 1 sol.

20 sols - - - 1 livre.

5 livres - - - 1 piece of eight at Genoa.

6 livres - - - 1 piece of eight at Leghorn.

N. B. The exchange at Florence is by ducatoons; the exchange at Venice by ducats.

NOTE. 6 solidi make 1 gross.

24 grosses - - - 1 ducat.

RULE. The same as before.

10. How

84 Exchange.

The NEW TUTOR'S

10. How much sterling money may a person receive in London, if he pays in Genoa 1056 dollars, at 53d. per dollar?
Ans. £233..4..-
11. A merchant remitted £233..4..- sterling to Leghorn, how many dollars will he receive there, the exchange being at 53d. per dollar?
Ans. 1056 dollars.
12. A factor sold goods at Florence for 280 ducatoons, at 54d. each, what is the value in pounds sterling?
Ans. £63.
13. A bill of £63. is remitted to Florence, to be paid in ducatoons, at 54d. each, how many will be received?
Ans. 280 ducatoons.
14. If 286 ducats, at 4s. 5d. each, be remitted from Venice to London, what is the value in pounds sterling?
Ans. £63..3..2.
15. A gentleman travelling, would exchange £63..3..2. sterling for Venice ducats, at 4s. 5d. each, how many must he receive?
Ans. 286 ducats.

IV. PORTUGAL.

They keep their accounts in Oporto and Lisbon in reas, and exchange on the milrea = 6s. 8d. $\frac{1}{2}$ at par.

NOTE, 1000 reas make one milrea.

RULE. The same as with France.

EXAMPLES.

16. A gentleman being desirous to remit to his correspondent in London 2895 milreas, exchange at 6s. 5d. per milrea, how much sterling will he be creditor for in London?
Ans. £928..16..3.
17. If a bill be drawn from London of £928..16..3. sterling, how many milreas, at 6s. 5d. each, is equal in value to the said sum?
Ans. 2895 milreas.
18. A merchant at Oporto remits to London 5473 milreas, and 183 reas, at 5s. 5d. $\frac{1}{2}$ exchange per milrea, how much sterling must be paid in London for this remittance?
Ans. £1490..17..5 $\frac{1}{4}$ $\frac{700}{1000}$.
19. If I pay a bill at London of £1490..17..5 $\frac{1}{4}$ $\frac{700}{1000}$, what must I draw for on my correspondent at Lisbon, exchange at 5s. 5d. $\frac{1}{2}$ per milrea?
Ans. 5473 milreas, 183 reas.

V. HOLLAND, FLANDERS, and GERMANY.

They keep their accounts at Antwerp, Amsterdam, Brussels, Rotterdam, and Hamburg, some in pounds, shillings, and

and pence, as in England; others in guilders, stivers, and pennings, and exchange with as on our pound at 33s. 4d. Flemish, at par.

NOTE. 8 pennings - make - 1 groat.
2 groats, or 16 pennings, 1 stiver.
20 stivers - - - - 1 guilder, or florin.

Also, 12 groats, or 6 stivers, make 1 schelling.
20 schellings, or 6 guilders, - 1 pound.

To change Flemish into sterling.

RULE. As the given rate : is to 1 pound :: so is the Flemish sum : to the sterling required.

To change sterling into Flemish.

RULE. As £1. sterling : is to the given rate :: so is the sterling given : to the Flemish sought.

EXAMPLES.

20. Remitted from London to Amsterdam, a bill of £873..10..-. sterling, how many pounds Flemish is the sum, exchange at 33s. 6d. Flemish per pound sterling?

Ans. £1463. 2 schel. 3 groats.

21. A merchant at Rotterdam remits £1463. 2 schel. 3 groats, Flemish, to be paid in London, how much sterling money must he draw for, the exchange being at 33s. 6d. Flemish per pound sterling?

Ans. £873..10..-.

22. If I pay in London £768..12..6. sterling, how many guilders must I draw for at Amsterdam, exchange at 34 schel. 4½ groats, Flemish, per pound sterling?

Ans. 26421 guilders, 5½ groats, ½ schel.

23. What must I draw for at London, if I pay at Amsterdam 26421 guilders, 5½ groats, ½ schel., exchange at 34 schel. 4½ groats, per pound sterling?

Ans. £768..12..6.

To convert bank money into current, and the contrary.

NOTE. The bank money is worth more than the current. The difference between the one and the other is called *agio*, and is generally from 3 to 6 per cent. in favour of the bank.

To change bank into current money.

RULE. An hundred guilders for a first term take
The same with *agio*, a second make
The given bank you have, the third should be,
And in the fourth, you'll the true answer see.

To change current money into bank.

RULE. An hundred and the proper agio take
For a first term, an hundred second make
The third the given current sum should be,
And in the fourth, you'll the true answer see.

24. Change 687 guilders, 15 stivers, current money, into bank florins, agio $4\frac{1}{2}$ per cent?

Ans. 658 guilders, 18 stivers, 7 penninge.

25. Change 658 guilders, 18 stivers, $7\frac{1}{2}$, bank, into current money, agio $4\frac{1}{2}$ per cent.?

Ans. 687 guilders, 15 stivers.

VI. I R E L A N D.

26. A gentleman remits to Ireland £857..15. -. sterling, what will he receive there, the exchange being at 10 per cent.?

Ans. £943..10..6.

27. What must be paid in London for a remittance of £943..10..6. Irish, exchange at 10 per cent.?

Ans. £857..15. -. -.

COMPARISON of WEIGHTS and MEASURES.

EXAMPLES.

1. If 60 Dutch pence be worth 75 French pence, how many Dutch pence are equal to 450 French pence?

Ans. £366.

2. If 12 yards at London make 9 ells at Paris, how many ells at Paris will make 86 yards at London?

Ans. $64\frac{1}{2}$.

3. If 50 lb. at London make 38 lb. at Amsterdam, how many lb. at London will be equal to 760 lb. at Amsterdam?

Ans. 600.

4. If 95 lb. Flemish make 110 lb. English, how many lb. English are 665 lb. Flemish?

Ans. 770.

CONJOINED PROPORTION

IS when the coin, weight, or measures of several countries are compared in the same question; or it is linking together a variety of proportions.

When it is required to find how many of the first sort of coin, weight, or measure mentioned in the question are equal to a given quantity of the last.

RULE. The numbers place alternate, at left hand
Begin, and then when done the last must stand
For dividend, the first row multiply,
The second for a sum to divide thereby.

EXAMPLES.

1. If 25 lb. at London make 30 lb. at Antwerp, and 160 lb. at Antwerp make 190 lb. at Leghorn, how many lb. at London are equal to 80 lb. at Leghorn?

<i>Left.</i>	<i>Right.</i>	
25	30	$30 \times 190 = 5700$ divisor.
160	190	$25 \times 160 \times 30 = 320000$ dividend.
80		$320000 \div 5700 = 56\frac{2}{3}$.

2. If 15 lb. at London make 12 lb. at Amsterdam, 112 lb. at Amsterdam 130 lb. at Thoulouse, how many lb. at London are equal to 50 lb. at Thoulouse? *Ans.* $53\frac{1}{2}$.

3. If 150 braces at Venice are equal to 160 braces at Leghorn, and 6 braces at Leghorn equal to 4 ells English, how many braces at Venice are equal to 16 ells English? *Ans.* $25\frac{2}{3}$.

4. If 44 lb. at London make 40 lb. at Amsterdam, and 96 lb. at Amsterdam make 120 lb. at Dantzick, how many lb. at London are equal to 136 lb. at Dantzick? *Ans.* $114\frac{11}{100}$.

When it is required to find how many of the last sort of coin, weight, or measure, mentioned in the question, is equal to a quantity of the first.

RULE. The numbers place alternate, at left hand
Begin, and on the right let the last stand,
For a divisor multiply first row,
The second multiply'd a dividend will shew.

EXAMPLES.

5. If 25 lb. at London make 30 lb. at Antwerp, 160 lb. at Antwerp 190 lb. at Leghorn, how many lb. at Leghorn are equal to 60 lb. at London? *Ans.* $85\frac{1}{2}$.

6. If 44 lb. at London make 40 lb. at Amsterdam, 96 lb. at Amsterdam 120 lb. at Dantzick, how many lb. at Dantzick are equal to 122 lb. at London? *Ans.* $144\frac{13}{100}$.

P R O G R E S S I O N

Consists of TWO PARTS.

ARITHMETICAL and GEOMETRICAL.

ARITHMETICAL PROGRESSION

IS when the rank of numbers increase or decrease regularly by the continual adding or subtracting of equal numbers; as 1, 2, 3, 4, 5, 6, are in Arithmetical Progression by the continual increasing or adding of one; 11, 9, 7, 5, 3, 1, by the continual decreasing or subtracting of two.

NOTE. When any even number of terms differ by Arithmetical Progression, the sum of the two extremes will be equal to the two middle numbers, or any two means equally distant from the extremes; as 2, 4, 6, 8, 10, 12, where $6+8$, the two middle numbers, are $=12+2$, the two extremes, and $=10+4$, the two means, $=14$.

When the number of terms are odd, the double of the middle term will be equal to the two extremes, or of any two means equally distant from the middle term; as, 1, 2, 3, 4, 5, where the double of 3 $=5+1=2+4=6$.

In Arithmetical Progression five things are to be observed, viz.

1. The first term; better expressed thus, f .
2. The last term, - - - - - l .
3. The number of terms, - - - - - n .
4. The equal difference, - - - - - d .
5. The sum of all the terms, - - - - - s .

Any three of which being given, the other two may be found.

I. F. L. N. are given to find S.

RULE. $f + l \times \frac{n}{2} = S$.

EXAMPLES.

1. How many strokes does the hammer of a clock strike in 12 hours? *Ans.* 78.

$$1+12=13 \text{ then } 13 \times 6 = 78.$$

2. A man buys 18 yards of cloth, and gave for the first yard 2s. and for the last 12s. what did the 18 yards amount unto? *Ans.* £6..6..-.

3. If 100 eggs were placed in a right line, exactly a yard asunder from one another, and the first a yard from a basket, what length of ground does that man go who gathers up these 100 eggs singly, returning with every egg to the basket to put it in? *Ans. 5 miles, 1300 yards.*

II. F. L. N. are given to find D.

$$l - f$$

RULE. $\frac{l - f}{n - 1} = D.$

$$n - 1$$

4. A man had 9 sons, the youngest was 6 years old, and the oldest 46, they increase in Arithmetical Progression, what was the common difference of their ages? *Ans. 5.*

$$46 - 6 = 40 \text{ then } 40 \div 9 - 1 = 5.$$

5. A man is to travel from London to a certain place in 12 days, and to go but 3 miles the first day, increasing every day by an equal excess, so that the last day's journey may be 69 miles, what is the daily increase, and how many miles distant is that place from London?

Ans. 6 daily increase, and 432 miles distance from London.

III. F. L. D. are given to find N.

RULE. $l - f$

$$\frac{l - f}{d} + 1 = N.$$

6. A person travelling into the country, went 3 miles the first day, and increased every day by 6 miles, till at last he went 69 miles in one day, how many days did he travel?

Ans. 12.

7. A person being asked how many sons he had, said, that the youngest was 6 years old, and the eldest 46, and that he increased one in his family every five years, how many had he?

Ans. 9.

IV. L. N. D. given to find F.

RULE. $l - d \times n - 1 = F.$

8. A man in 12 days went from London to a certain town in the country, every day's journey increasing the former by 6, and the last he went was 69 miles, what was the first?

$$6 \times 12 - 1 = 66, \text{ then } 69 - 66 = 3 \text{ First.}$$

Ans. 3.

9. A man takes out of his pocket at 9 several times so many different number of shillings, every one exceeding the former by 5, the last 46, what was the first? *Ans. 6.*

V. N. D. S. are given to find F.

RULE. $\frac{1}{n} - \frac{d \times n - 1}{2} = F.$

10. A person is to receive £450. at 10 several payments, each to exceed the former by £6. and is willing to bestow the first payment on any one that can tell him what it is?

Ans. £18.

$$450 \div 10 = 45 \text{ then } 45 - \frac{6 \times 10 - 1}{2} = 18.$$

VI. F. N. D. are given to find L.

RULE. $nd - d + f = L.$

11. What is the last number of an Arithmetical Progression, beginning at 8, and continuing by the increase of 6 to 20 places?

Ans. 122.

$$20 \times 6 - 6 = 114 \text{ then } 114 + 8 = 122.$$

VII. F. N. D. are given to find S.

RULE. $\frac{nd - d + f \times 2}{2} \times n = S.$

12. A person being to receive a sum of money by 10 equal payments, the first to be £18. and each payment to increase the former by 6, what was the sum he was to receive?

Ans. £450.

$$10 \times 6 - 6 = 54 + 18 \times 2 \\ \frac{\quad}{2} : \times 10 = 450.$$

GEOMETRICAL PROGRESSION

IS the increasing or decreasing of any rank of numbers by some common ratio; that is, by the continual multiplication or division of some equal number; as 2, 4, 8, 16, increase by the multiplier 2; and 16, 8, 4, 2, decrease by the divisor 2.

I

NOTE.

NOTE. When any number of terms is continued in Geometrical Progression, the product of the two extremes will be equal to any two means, equally distant from the extremes; as 2, 4, 8, 16, 32, 64, where $64 \times 2 = 4 \times 32$, and $8 \times 16 = 128$.

When the number of terms is odd, the middle term multiplied into itself will be equal to the two extremes, or any two means, equally distant from the mean; as 2, 4, 8, 16, 32, where $2 \times 32 = 4 \times 16 = 8 \times 8 = 64$.

In Geometrical Progression the same five things are to be observed as in Arithmetical, viz.

1. The first term.
2. The last term.
3. The number of terms.
4. The equal difference or ratio.
5. The sum of all the terms.

NOTE. As the last term in a long series of numbers is very tedious to come at, by continual multiplication; therefore, for the reader finding it out, there is a series of numbers made use of in Arithmetical Proportion, called indices, beginning with an unit, whose common difference is one; whatever number of indices you make use of, set as many numbers (in such Geometrical Proportion as is given in the question) under them:

As ¹1, 2, 3, 4, 5, 6. Indices.
 2, 4, 8, 16, 32, 64. Numbers in geometrical proportion.

But if the first term in geometrical proportion be different from the ratio, the indices must begin with a cypher.

As ⁰1, 2, 3, 4, 5, 6. Indices.
 1, 2, 4, 8, 16, 32, 64. Numbers in geometrical proportion.

When the indices begin with a cypher, the sum of the indices made choice of must always be one less than the number of terms given in the question; for 1 in the indices is over the second term, and two over the third, &c.

Add any two of the indices together, and that sum will agree with the product of their respective terms.

As in the first table of indices $2 + 5 = 7$
 Geometrical Proportion $4 \times 32 = 128$

Then in the second $2 + 4 = 6$
 $4 \times 16 = 64$

In

In any Geometrical Progression proceeding from unity, the ratio being known, to find any remote term, without producing all the intermediate terms.

RULE. Those figures of the indices first take,
Which will when added the exponent make;
The numbers under them then multiply
Into each other, and you will thereby
The term you wanted speedily supply. }

Note. When the exponent 1 stands over the second term, the number of exponents must be 1 less than the number of terms.

E X A M P L E S.

1. A man agrees for 12 peaches, to pay only the price of the last, reckoning a farthing for the first, an halfpenny for the second, &c. doubling the price to the last; what must he give for them? *Ans.* £2..2..8.

0, 1, 2, 3, 4, Exponents.

$$16 = 4$$

1, 2, 4, 8, 16, No. of terms.

$$16 = 4$$

$$256 = 8$$

$$8 = 3$$

For $4 + 4 + 3 = 11$, No. of terms less 1.

$$4)2048 = 11 \text{ No. of farth.}$$

$$12) 512$$

$$210)412..8$$

$$£2..2..8$$

2. A country gentleman going to a fair to buy some oxen, meets with a person who had 21; he demanding the price of them, was answered £15. a piece; the gentleman bids him £14. a piece, and he would buy all; the other tells him it could not be taken, but if he would give what the last ox would come to, at a farthing for the first, and doubling it to the last, he should have all. What was the price of the oxen? *Ans.* £1092..1..4.

In any Geometrical Progression, not proceeding from unity, the ratio being given, to find any remote term, without producing all the intermediate terms.

RULE.

RULE. By precepts of last rule abide
And after by first term divide.

EXAMPLES.

3. A sum of money is to be divided among 9 persons, the first to have £30. the next £90. and so on in triple proportion; what will the last have?

0, 1, 2, 3, 4, $4+4=8$, one less than number of terms.
30, 90, 270, 810, 2430,
 2430×2430

=1968306.

30

4. A gentleman dying, left ten sons, to whom and to his executors he bequeathed his estate in manner following: To his executors £50. his youngest son was to have as much more as the executors; and each son to exceed the next younger by as much more. What was the eldest son's portion?

Ans. £51200.

The first term, ratio, and number of terms given to find the sum of all the terms.

RULE. Just as before the last term find

Subtract the first from it, and mind

What's o'er by ratio less one

Divide, with care that being done,

Add the last term to quote, you'll see

Whate'er the sum requir'd should be.

EXAMPLES.

5. A servant skilled in numbers agreed with a gentleman to serve him 12 months, provided he would give him a farthing for his first month's service, a penny for the second, and fourpence for the third, &c. what did his wages amount to?

Ans. £5825..8..5½.

0, 1, 2, 3, 4, $4+4+3=11$, No. of terms less 1.
1, 4, 16, 64, 256,
 $256 \times 256 = 65536$, then $65536 \times 64 = 4194304$
 $4194304 - 1$

=1398101

4-1

$1398101 + 4194304 = 5592405$ farthings.

6. A man bought a horse, and by agreement was to give a farthing for the first nail, three for the second, &c. there were four shoes, and in each shoe 8 nails; what was the worth of the horse?

Ans. £965114681693..13..4.

7. A certain person married his daughter on New-year's day, and gave her husband £1. towards her portion, promising to double it on the first day of every month for one year; what was her portion? *Ans. £4095.*

8. A laceman well versed in numbers agreed with a gentleman to sell him 22 yards of rich gold-brocaded lace, for 2 pins the first yard, 6 pins the second, &c. in triple proportion, I desire to know what he sold the lace for, if the pins were valued at 100 for a farthing; also what the laceman got or lost by the sale thereof, supposing the lace stood him in £7. per yard? *Ans. The lace sold for £326886...9. Gain, £326732...9.*

P E R M U T A T I O N

IS the changing or varying the order of things.

RULE. The given terms together multiply'd,
Will all the changes possible provide.

E X A M P L E S.

1. How many changes may be rung upon 12 bells; and how long would they be ringing once over, supposing 10 changes might be rung in one minute, and the year to contain 365 days, 6 hours?

Answer.

$$1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10 \times 11 \times 12 = 479001600$$

changes, which $\div 10 = 47900160$ minutes; which reduced, are = 91 years, 3 weeks, 5 days, 6 hours.

2. A young scholar coming into town, for the convenience of a good library, demands of a gentleman with whom he lodged, what his diet would cost for a year; who told him £10. but the scholar not being certain what time he should stay, asked him what he must give him for so long as could place his family (consisting of 6 persons besides himself) in different positions, every day at dinner; the gentleman thinking it would not be long, tells him £5. to which the scholar agrees. What time did the scholar stay with the gentleman? *Ans. 5040 days.*

T H E

NEW TUTOR'S ASSISTANT.

P A R T II.

V U L G A R F R A C T I O N S.

A FRACTION is a part or parts of an unit, and written with two figures, with a line between them, as $\frac{1}{2}$, $\frac{3}{8}$, $\frac{2}{5}$, $\frac{4}{7}$, &c.

The figure above the line is called the numerator, and the under one the denominator; which shews how many parts the unit is divided into; and the numerator shews how many of those parts are meant by the fraction.

There are four sorts of Vulgar Fractions; *proper*, *improper*, *compound*, and *mixed*; viz.

1. A **PROPER FRACTION** is when the numerator is less than the denominator, as $\frac{2}{3}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{2}{5}$, $\frac{103}{703}$, &c.

2. An **IMPROPER FRACTION** is when the numerator is equal to, or greater than, the denominator, as $\frac{4}{3}$, $\frac{7}{2}$, $\frac{13}{4}$, $\frac{105}{4}$, &c.

3. A **COMPOUND FRACTION** is the fraction of a fraction, and known by the word *of*, as $\frac{1}{2}$ of $\frac{1}{3}$, of $\frac{6}{7}$, of $\frac{7}{12}$, of $\frac{8}{15}$, &c.

4. A **MIXED NUMBER OR FRACTION** is composed of a whole number and fraction, as $2\frac{1}{2}$, $14\frac{1}{8}$, $7\frac{1}{5}$, &c.

REDUCTION

REDUCTION of VULGAR FRACTIONS.

1. To reduce fractions to a common denominator.

RULE 1. Let every num be multiply'd alone
By all the dens you have except it's own
For a new num. The dens all multiply'd
Together, will a common den provide.

NOTE. Num stands for numerator, and den for denominator.

EXAMPLES.

1. Reduce $\frac{3}{4}$ and $\frac{5}{6}$ to a common denominator.

Facit $\frac{9}{12}$ and $\frac{10}{12}$.

$3 \times 6 = 18$ $4 \times 5 = 20$ then $4 \times 7 = 28$ den. $= \frac{20}{28}$ and $\frac{15}{28}$.

2. Reduce $\frac{1}{2}$, $\frac{2}{3}$, and $\frac{3}{4}$, to a common denominator.

Facit $\frac{6}{12}$, $\frac{8}{12}$, $\frac{9}{12}$.

3. Reduce $\frac{1}{5}$, $\frac{1}{4}$, $\frac{1}{3}$, and $\frac{1}{2}$ to a common denominator.

Facit $\frac{6}{60}$, $\frac{15}{60}$, $\frac{20}{60}$, $\frac{30}{60}$.

4. Reduce $\frac{1}{6}$, $\frac{1}{5}$, $\frac{1}{4}$, and $\frac{1}{3}$ to a common denominator.

Facit $\frac{10}{60}$, $\frac{12}{60}$, $\frac{15}{60}$, $\frac{20}{60}$.

5. Reduce $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{5}$ to a common denominator.

Facit $\frac{15}{60}$, $\frac{20}{60}$, $\frac{15}{60}$, $\frac{12}{60}$.

6. Reduce $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{5}$ to a common denominator.

Facit $\frac{15}{60}$, $\frac{20}{60}$, $\frac{15}{60}$, $\frac{12}{60}$.

2. To reduce a vulgar fraction to its lowest terms.

RULE 2. A proper common measure to obtain,
The den by num divide; divide again
The last divisor by what doth remain.
And so go on, till there remains a nought,
The last divisor is the measure sought.
By common measure num and den divide,
The quotients then the answer will provide.

Note. If the common measure happen to be 1, the fraction is already in its lowest term; and when fractions have cyphers at the right hand, they may be abbreviated by cutting them off; as $\frac{2}{10} = \frac{1}{5}$.

EXAMPLES.

7. Reduce $\frac{27}{36}$ to its lowest terms.

$$\begin{array}{r} 27 \overline{) 36} 1 \\ \underline{27} \end{array}$$

then $9 \overline{) \frac{27}{36}} = \frac{3}{4}$ Facit.

$$9 \overline{) 27} 3$$

8. Reduce

ASSISTANT. *Reduction of Vulgar Fractions.* 97

8. Reduce $\frac{42}{775}$ to its lowest terms. *Facit* $\frac{6}{119}$.
9. Reduce $\frac{260}{831}$ to its lowest terms. *Facit* $\frac{52}{177}$.
10. Reduce $\frac{156}{780}$ to its lowest terms. *Facit* $\frac{1}{5}$.
11. Reduce $\frac{310}{1890}$ to its lowest terms. *Facit* $\frac{1}{6}$.
12. Reduce $\frac{7107}{18912}$ to its lowest terms. *Facit* $\frac{1}{4}$.

3. To reduce a mixed number to an improper fraction.

RULE. The whole number multiply by den,
Take num into the product, then
Under that product put the den.

Note, To express a whole number fraction-ways, set 1 for the denominator given.

EXAMPLES.

13. Reduce $14\frac{3}{7}$ to an improper fraction. *Facit* $\frac{103}{7}$.
 $14 \times 7 + 3 = 103$ new numerator, $\frac{1199}{260}$.
14. Reduce $57\frac{3}{7}$ to an improper fraction. *Facit* $\frac{1199}{260}$.
15. Reduce $156\frac{3}{5}$ to an improper fraction. *Facit* $\frac{783}{5}$.
16. Reduce $24\frac{1}{12}$ to an improper fraction. *Facit* $\frac{299}{12}$.
17. Reduce $28\frac{3}{5}$ to an improper fraction. *Facit* $\frac{143}{5}$.
18. Reduce $257\frac{3}{8}$ to an improper fraction. *Facit* $\frac{2117}{8}$.

4. To reduce an improper fraction to its proper terms.

RULE. By lower th' upper term divide,
The quote the answer will provide.

EXAMPLES.

19. Reduce $\frac{103}{7}$ to its proper terms. *Facit* $14\frac{5}{7}$.
 $103 \div 7 = 14\frac{5}{7}$.
20. Reduce $\frac{1199}{260}$ to its proper terms. *Facit* $57\frac{3}{7}$.
21. Reduce $\frac{783}{5}$ to its proper terms. *Facit* $156\frac{3}{5}$.
22. Reduce $\frac{299}{12}$ to its proper terms. *Facit* $24\frac{1}{12}$.
23. Reduce $\frac{143}{5}$ to its proper terms. *Facit* $28\frac{3}{5}$.
24. Reduce $\frac{2117}{8}$ to its proper terms. *Facit* $257\frac{3}{8}$.

5. To reduce a compound fraction to a single one.

RULE. Multiply all the nums for a new num,
Do so with dens, a proper den will come.

EXAMPLES.

25. Reduce $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ to a single fraction.
Facit $\frac{2 \times 3 \times 4 = 24}{3 \times 4 \times 5 = 60}$ reduced to its lowest term = $\frac{2}{5}$.

K

26. Reduce

98 Reduction of Vulgar Fractions, The New Tutor's

26. Reduce $\frac{2}{3}$ of $\frac{5}{7}$ of $\frac{7}{8}$ to a single fraction.

Facit $\frac{310}{336} = \frac{1}{1}$.

27. Reduce $\frac{1}{2}$ of $\frac{3}{5}$ of $\frac{9}{10}$ to a single fraction.

Facit $\frac{304}{720} = \frac{7}{10}$.

28. Reduce $\frac{1}{8}$ of $\frac{11}{12}$ of $\frac{11}{13}$ to a single fraction.

Facit $\frac{1188}{1300} = \frac{99}{130}$.

29. Reduce $\frac{2}{7}$ of $\frac{5}{8}$ of $\frac{1}{4}$ to a single fraction.

Facit $\frac{30}{112} = \frac{5}{28}$.

30. Reduce $\frac{1}{2}$ of $\frac{4}{5}$ of $\frac{3}{10}$ to a single fraction.

Facit $\frac{60}{125} = \frac{2}{5}$.

6. To reduce fractions of one denomination to the fraction of another, but greater, retaining the same value.

RULE. To make the given fraction one compound, Compare it with the various names, that found Between itself, and that which you would use, Then to a simple fraction that reduce.

EXAMPLES.

31. Reduce $\frac{2}{3}$ of a penny to the fraction of a pound.

Facit $\frac{2}{3}$ of $\frac{1}{12}$ of $\frac{1}{20} = \frac{1}{440}$.

32. Reduce $\frac{1}{2}$ of a penny to the fraction of a pound.

Facit $\frac{1}{1920}$.

33. Reduce $\frac{3}{4}$ of a penny-weight to the fraction of a lb. troy.

Facit $\frac{3}{80}$.

34. Reduce $\frac{1}{2}$ of a lb. avoirdupoise to the fraction of an cwt.

Facit $\frac{1}{14}$.

7. To reduce fractions of one denomination to the fraction of another, but less, retaining the same value.

RULE. Multiply num, by all the parts that's seen In all the various names that's found between Itself, and that you want it to, and then Beneath the product place the given den.

EXAMPLES.

35. Reduce $\frac{1}{1440}$ of a pound to the fraction of a penny.

$4 \times 20 \times 12 = \frac{960}{1440}$ reduced to its lowest term $= \frac{1}{2}$.

36. Reduce $\frac{1}{1920}$ of a pound to the fraction of a penny.

Facit $\frac{1}{2}$.

37. Reduce $\frac{1}{80}$ of a lb. troy, to the fraction of a penny weight.

Facit $\frac{1}{2}$.

38. Reduce $\frac{1}{14}$ of an cwt. to the fraction of a lb. avoirdupoise.

Facit $\frac{1}{2}$.

8. To

ASSISTANT. *Reduction of Vulgar Fractions.* 99

8. To reduce fractions of one denomination to another of the same value, having the numerator given of the required fraction.

RULE. The given fraction's num a first term make,
Its den a second, for a third then take,
The num of fraction wanted, and you'll see
The answer may be found by *Rule of Three*.

EXAMPLES.

39. Reduce $\frac{3}{5}$ to a fraction of the same value, whose numerator shall be 15. As $3 : 5 :: 15 : 25$. Facit $\frac{15}{25}$.

40. Reduce $\frac{2}{3}$ to a fraction of the same value whose numerator shall be 28. Facit $\frac{28}{42}$.

41. Reduce $\frac{1}{2}$ to a fraction of the same value, whose numerator shall be 49. Facit $\frac{49}{98}$.

9. To reduce fractions of one denomination to another of the same value, having the denominator given of the fraction required.

RULE. The given fraction's den a first term make
Its num a second, for a third then take
The den of fraction wanted, and you'll see
The answer may be found by *Rule of Three*.

42. Reduce $\frac{3}{5}$ to a fraction of the same value, whose denominator shall be 25. As $5 : 3 :: 25 : 15$. Facit $\frac{15}{25}$.

43. Reduce $\frac{2}{3}$ to a fraction of the same value, whose denominator shall be 35. Facit $\frac{28}{35}$.

44. Reduce $\frac{1}{2}$ to a fraction of the same value, whose denominator shall be 68 $\frac{1}{2}$. Facit $\frac{49}{68\frac{1}{2}}$.

10. To reduce a mixed fraction to a single one.

RULE. Whene'er the num the mixed part may be,
Then multiply it by the den you see
In part that's fractional, and to it add
The fractional num, and so a new num's had;
The dens of both together multiply'd,
A new denominator will provide.

EXAMPLES.

45. Reduce $35\frac{3}{5}$ to a simple fraction. Facit $\frac{178}{25}$.

47
 $35 \times 5 + 3 = 178$ numerator.
 $47 \times 5 = 235$ denominator.

K 2

46. Reduce

100 Reduction of Vulgar Fractions. The New Tutor's

- 294
46. Reduce $\frac{294}{35}$ to a simple fraction. Facit $\frac{208}{143}$.

RULE 10. Second part.

When'er the *den* the mixed part may be,
Then multiply it by the *den* you see
In part that's fractional, and to it add
The fractional *num*, and so a new *den*'s had;
By fractional *den* then multiply the *num*
Of fraction, and you'll find the answer come.

EXAMPLES.

47. Reduce $\frac{49}{68\frac{1}{17}}$ to a simple fraction. Facit $\frac{243}{113}$.
48. Reduce $\frac{17}{25\frac{1}{3}}$ to a simple fraction. Facit $\frac{43}{113}$.

11. To find the proper quantity of a fraction in the known parts of an integer.

RULE. Let *num* by the known parts be multiply'd
Of an integer, that sum by *den* divide,

EXAMPLES.

49. Reduce $\frac{2}{3}$ of a pound sterling to its proper quantity.
 $2 \times 20 = 40 \div 3 = 13s. 4d.$ Facit 13s. 4d.
50. Reduce $\frac{1}{4}$ of a shilling to its proper quantity.
Facit 9d.
51. Reduce $\frac{2}{3}$ of a lb. avoirdupoise to its proper quantity.
Facit 9 ounces, 9 dr. $\frac{1}{3}$.
52. Reduce $\frac{1}{4}$ of cwt. to its proper quantity.
Facit 2 qrs. 24 lb.
53. Reduce $\frac{2}{3}$ of a lb. troy to its proper quantity.
Facit 9 oz. 12 dwt.
54. Reduce $\frac{2}{3}$ of an English ell to its proper quantity.
Facit 3 qrs. 3 na. $\frac{1}{3}$.
55. Reduce $\frac{1}{4}$ of a mile to its proper quantity.
Facit 3 fur. 17 poles $\frac{1}{4}$.
56. Reduce $\frac{1}{4}$ of an acre to its proper quantity.
Facit 1 rood, 20 poles.
57. Reduce $\frac{1}{4}$ of an hoghead of wine to its proper quantity.
Facit 46 galls. 1 quart $\frac{1}{4}$.
58. Reduce

ASSISTANT. Reduction of Vulgar Fractions. 101

58. Reduce $\frac{2}{3}$ of a barrel of beer to its proper quantity.

Facit 16 galls.

59. Reduce $\frac{7}{12}$ of a chaldron of coals, to its proper quantity.

Facit 21 bushels.

60. Reduce $\frac{1}{4}$ of a month to its proper time.

Facit 1 week, 5 days.

12. To reduce any given quantity to the fraction of any greater denomination retaining the same value.

RULE. Reduce the quantum given to that name

You find the lowest mention'd for a num.

Reduce the integer unto the same,

And place it as a den the answer'll come.

E X A M P L E S.

61. Reduce 13s. 4d. to the fraction of a pound sterling.

Facit $\frac{2}{3}$.

$13 \times 12 + 4 = 160$ num. $20 \times 12 = 240$ den. $\frac{160}{240} = \frac{2}{3}$.

62. Reduce 9d. to the fraction of a shilling.

Facit $\frac{3}{4}$.

63. Reduce 9 oz. 9 dr. $\frac{3}{4}$ to the fraction of a lb. avoirdupoise.

Facit $\frac{1}{2}$.

64. Reduce 2 qrs. 14 lb. to the fraction of an cwt.

Facit $\frac{3}{4}$.

65. Reduce 9 oz. 12 dwts. to the fraction of a lb. troy.

Facit $\frac{2}{3}$.

66. Reduce 3 qrs. 3 nails, $\frac{2}{3}$ to the fraction of an ell.

Facit $\frac{7}{8}$.

67. Reduce 3 fur. 17 poles, $\frac{1}{2}$ to the fraction of a mile.

Facit $\frac{3}{4}$.

68. Reduce 1 rood, 20 poles, to the fraction of an acre.

Facit $\frac{1}{2}$.

69. Reduce 54 gal. to the fraction of an hoghead of wine.

Facit $\frac{6}{7}$.

70. Reduce 16 galls. to the fraction of a barrel of beer.

Facit $\frac{2}{3}$.

71. Reduce 21 bushels to the fraction of a chaldron.

Facit $\frac{7}{12}$.

72. Reduce 12 days to the fraction of a month.

Facit $\frac{1}{2}$.

ADDITION of VULGAR FRACTIONS.

RULE. Unto a common *den* reduce
The fractions, which you have in use
Together add the *nums*, and then
Write underneath the common *den*.

EXAMPLES.

1. Add $\frac{2}{3}$ and $\frac{1}{3}$ together. *Facit* $\frac{10}{15} + \frac{5}{15} = \frac{15}{15} = 1 \frac{1}{5}$
2. Add $\frac{1}{3}$, $\frac{1}{4}$ and $\frac{2}{5}$ together. - - - *Facit* $1 \frac{10}{60}$.
3. Add $\frac{1}{2}$, $5 \frac{1}{4}$, and $2 \frac{3}{5}$ together. - - - *Facit* $8 \frac{3}{4}$.
4. Add $7 \frac{1}{4}$ and $\frac{3}{8}$ together. - - - *Facit* $8 \frac{1}{2}$.
5. Add $\frac{1}{2}$ of $\frac{1}{2}$ and $\frac{1}{4}$ together. - - - *Facit* $\frac{1}{2}$.
6. Add $2 \frac{1}{3}$, $5 \frac{2}{3}$, and $6 \frac{1}{3}$ together. - - *Facit* $14 \frac{2}{3}$.
2. When the fraction are the several denominations, reduce them to their proper quantities, and add as before.
7. Add $\frac{1}{6}$ of a pound to $\frac{1}{3}$ of a shilling. *Facit* $17s. 5d. \frac{1}{2}$.
8. Add $\frac{1}{4}$ of a pound to $\frac{1}{3}$ of a penny. *Facit* $10s. 0d. \frac{1}{2}$.
9. Add $\frac{1}{4}$ of a lb. troy to $\frac{1}{5}$ of an ounce.
Facit $4 \text{ oz. } 2 \text{ dwts. } 2 \text{ gr. } \frac{1}{5}$.
10. Add $\frac{1}{4}$ of a ton to $\frac{1}{5}$ of a lb.
Facit $12 \text{ cwt. } 0 \text{ qr. } 0 \text{ lb. } 9 \text{ oz. } 2 \text{ drams, } \frac{2}{5}$.
11. Add $\frac{1}{4}$ of a chaldron to $\frac{1}{5}$ of a bushel.
Facit $27 \text{ bush. } 2 \text{ pecks } \frac{2}{5}$.
12. Add $\frac{1}{4}$ of a yard to $\frac{1}{5}$ of a foot,
Facit $12 \frac{1}{5} \text{ inches.}$

SUBTRACTION of VULGAR FRACTIONS.

RULE. Unto a common *den* reduce
The fractions which they have in use;
From greater take less *num*, and then
Write underneath the common *den*.

EXAMPLES.

1. From $\frac{2}{3}$ take $\frac{1}{5}$. $2 \times 5 = 10$. $3 \times 3 = 9$. $10 - 9 = 1 \text{ num.}$
 $3 \times 5 = 15 \text{ den.}$ - - - - *Facit* $\frac{1}{15}$.
2. From

ASSISTANT. Multiplication of Vulgar Fractions. 103

2. From $\frac{4}{5}$ take $\frac{2}{3}$ of $\frac{3}{4}$. - - - - Facit $\frac{28}{60}$.
3. From $7\frac{2}{3}$ take $\frac{2}{3}$ of $\frac{1}{4}$. - - - - Facit $7\frac{3}{12}$.
4. From $\frac{3}{7}$ take $\frac{1}{3}$. - - - - Facit $\frac{1}{21}$.
5. From $\frac{3}{8}$ take $\frac{2}{3}$ of $\frac{3}{4}$. - - - - Facit $\frac{1}{4}$.
6. From $59\frac{2}{3}$ take $5\frac{6}{7}$. - - - - Facit $53\frac{11}{21}$.

When fractions are of several denominations.

If you the fractions which you have, should find
Of several denominations, mind
Unto their proper quantums, them reduce,
And then subtract by rules before in use.

7. From $\frac{1}{4}$ of a pound take $\frac{2}{3}$ of a shilling.
Facit 14s. 4d.
8. From $\frac{3}{4}$ of a shilling take $\frac{1}{4}$ of a penny.
Facit 8d. $\frac{1}{2}$.
9. From $\frac{1}{2}$ of a lb. troy, take $\frac{1}{3}$ of an ounce.
Facit 8 oz. 13 dwts. 8 grs.
10. From $\frac{1}{2}$ of a ton, take $\frac{1}{4}$ of a lb.
Facit 16 cwt. 2 grs. 17 lb. 14 oz. $\frac{2}{3}$.
11. From $\frac{1}{2}$ of a chaldron take $\frac{2}{3}$ of a bushel.
Facit 11 bush. 1 peck, 0 gal. $\frac{2}{3}$.
12. From $\frac{1}{2}$ of a yard take $\frac{1}{4}$ of a foot. Facit 9 inch.

MULTIPLICATION of VULGAR FRACTIONS.

RULE. Your numbers, if they want it, first prepare
By the good rules that in Reduction are;
Multiply all the *nums.* for a new *num.*
Do so with *den.* a proper *den.* will come.

EXAMPLES.

1. Multiply $\frac{2}{3}$ by $\frac{3}{4}$. Facit $2 \times 3 = 6$. $3 \times 4 = 12$. $\frac{6}{12} = \frac{1}{2}$.
2. Multiply $\frac{2}{3}$ by $\frac{3}{4}$. - - - - Facit $\frac{1}{2}$.
3. Multiply $27\frac{2}{3}$ by $12\frac{5}{6}$. - - - - Facit $351\frac{18}{6}$.
4. Multiply $270\frac{2}{3}$ by $57\frac{1}{4}$. - - - - Facit $15495\frac{2}{4}$.
5. Multiply $\frac{1}{2}$ by $\frac{2}{3}$ of $\frac{1}{4}$ of $\frac{3}{4}$. - - - - Facit $\frac{1}{12}$.
6. Multiply $\frac{1}{4}$ by $\frac{2}{3}$ of $\frac{1}{4}$ of $\frac{3}{4}$. - - - - Facit $\frac{1}{24}$.
7. Multiply $\frac{1}{4}$ of $\frac{2}{3}$ by $\frac{1}{2}$ of $\frac{1}{4}$. - - - - Facit $\frac{1}{24}$.
8. Multiply

104 Division of Vulgar Fractions. The New Tutor's

8. Multiply $72 \frac{1}{2}$ by $7 \frac{2}{3}$. - - - Facit $534 \frac{11}{6}$.
9. Multiply $4 \frac{2}{3}$ by $\frac{1}{2}$. - - - Facit $3 \frac{1}{3}$.
10. Multiply 37 by $\frac{1}{2}$. - - - Facit $27 \frac{1}{2}$.
11. Multiply $\frac{2}{3}$ of 9 by $\frac{1}{2}$ of 4. - - Facit $3 \frac{2}{3}$.
12. Multiply $12 \frac{5}{8}$ by $\frac{1}{2}$ of $\frac{1}{2}$. - - Facit $1 \frac{11}{8}$.

DIVISION of VULGAR FRACTIONS.

RULE. Your given numbers, if they are
 Not simple fractions, them prepare
 By rules Reduction will supply;
 Divisors *den* then multiply
 By *num* of dividend; and then
 Divisors *num* into the *den*
 Of dividend, and the first sum
 You then must take for a new *num*.
 The last for a new *den* then take,
 And so your work complete you'll make.

EXAMPLES.

1. Divide $7 \frac{1}{2}$ by $\frac{1}{2}$. - - - Facit 1.
2. Divide $1 \frac{2}{3}$ by $\frac{1}{3}$. - - - Facit $1 \frac{2}{3}$.
3. Divide $27 \frac{1}{2}$ by $3 \frac{1}{2}$. - - - Facit $7 \frac{11}{7}$.
4. Divide $275 \frac{1}{2}$ by $25 \frac{1}{2}$. - - - Facit $8 \frac{1073}{10}$.
5. Divide $\frac{1}{2}$ by $\frac{2}{3}$ of $\frac{1}{2}$. - - - Facit $1 \frac{1}{2}$.
6. Divide $\frac{2}{3}$ of 15 by $\frac{2}{3}$ of $\frac{1}{2}$. - - Facit 35.
7. Divide $\frac{1}{2}$ of $\frac{1}{2}$ by $\frac{1}{2}$ of $\frac{2}{3}$. - - Facit $\frac{1}{3}$.
8. Divide $7 \frac{1}{2}$ by $\frac{1}{2}$ of 8. - - - Facit $3 \frac{7}{2}$.
9. Divide $\frac{1}{2}$ by $4 \frac{1}{2}$. - - - Facit $\frac{1}{25}$.
10. Divide 18 by 6. - - - Facit 3.
11. Divide $2701 \frac{1}{2}$ by $7 \frac{1}{2}$. - - - Facit $346 \frac{43}{11}$.
12. Divide $2 \frac{1}{2}$ by $7 \frac{1}{2}$. - - - Facit $\frac{1}{21}$.

The SINGLE RULE of THREE DIRECT. in VULGAR FRACTIONS.

RULE. Reduce your numbers till you see
The first and third in name agree,
The former *num* then multiply
By both the latter *den*s, thereby
A proper *den* you will supply.
Next multiply the former *den*
By both the latter *num*s, and then
A proper *num* is found; which, when
Reduce into its value true
It will the proper answer shew.

EXAMPLES.

1. If $\frac{1}{2}$ of a yard cost $\frac{1}{4}$ of a pound, what will $\frac{1}{2}$ of a yard come to at that rate? *Ans.*

$$\frac{1}{2} yd. : \frac{1}{4} £ :: \frac{1}{2} yd. : 2 £.$$

for $4 \times 4 \times 7 = 112$ num. or $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ $\frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$ $(\frac{1}{16} = 1 £.$
and $1 \times 7 \times 8 = 56$ den.

2. If $\frac{1}{4}$ of a yard cost $\frac{1}{2}$ of a pound, what will $\frac{1}{2}$ of a yard cost? *Ans.* 16s. 3d. $\frac{1}{2}$.

3. If $\frac{1}{2}$ of a yard of lawn cost 13s. 4d. what will 10 yards $\frac{1}{2}$ cost? *Ans.* £10..6..8.

4. If 10 $\frac{1}{2}$ yards of muslin cost £10..6..8. what will $\frac{1}{2}$ of a yard cost? *Ans.* 13s. 4d.

5. If $\frac{1}{2}$ of an ell of holland cost $\frac{1}{2}$ £. what will 10 $\frac{1}{2}$ elle cost at that rate? *Ans.* £5..6.

6. If $5 \frac{1}{2}$ yards of cloth cost 15s. 9d. what will 27 $\frac{1}{2}$ cost at the same rate? *Ans.* £3..18..4. $\frac{1}{2}$.

7. If $\frac{1}{2}$ of an cwt. cost 276s. what will $54 \frac{1}{2}$ cwt. cost at the same rate? *Ans.* £1067..0..8. $\frac{1}{2}$.

8. If 5 yards of broad cloth cost £2. $\frac{1}{2}$, what will 12 yds. $\frac{1}{2}$ cost? *Ans.* £6..10..6.

9. If $\frac{1}{2}$ yard cost $\frac{1}{2}$ £. what will $\frac{1}{2}$ of an English ell come to at the same rate? *Ans.* £1..6..8.

10. If 1 $\frac{1}{4}$ lb. of cochineal cost £1. 10s. what will 36 $\frac{1}{4}$ lb. come to? *Ans.* £43..19..0.

11. If a yard of broad cloth cost 13s. $\frac{1}{2}$. what will 5 pieces cost, each containing 25 yards $\frac{1}{2}$? *Ans.* £87..4..-

12. Bought 5 pieces $\frac{1}{2}$ of silk, each containing 25 ells $\frac{1}{2}$ at 5s. 0d. $\frac{1}{2}$. per ell, I desire to know what the whole quantity cost? *Ans.* £35..13..6.

The SINGLE RULE of THREE INVERSE,
in VULGAR FRACTIONS.

EXAMPLES.

- I**F 34 men can build a wall in 27 days $\frac{1}{4}$, how many men can do the same in 152 days? *Ans.* 6 men $\frac{23}{8}$.
2. If 25s. $\frac{3}{4}$ will pay for the carriage of an cwt. 135 miles $\frac{1}{2}$, how far may 5 cwt. $\frac{1}{2}$ be carried for the same money? *Ans.* 24 miles $\frac{1}{2}$.
3. If 4 $\frac{3}{4}$ yards of cloth, that is 1 $\frac{3}{4}$ yard wide be sufficient to make a cloak, how much must I have of that sort which is $\frac{3}{4}$ yard wide to make another of the same bigness? *Ans.* 8 $\frac{2}{3}$ yards.
4. If 5 men can do a piece of work in 4 $\frac{1}{2}$ hours, in how many hours will 12 men do the same? *Ans.* 1 $\frac{1}{2}$ hour.
5. If a penny white loaf weigh 8 oz. when a bushel of wheat cost 5s. 6d. what is the bushel worth when the penny white loaf weighs but 2 ounces $\frac{1}{2}$? *Ans.* 17s. 7d. $\frac{1}{2}$.
6. What quantity of shalloon that is $\frac{3}{4}$ wide will line 7 yards $\frac{1}{2}$ of cloth that is $\frac{1}{2}$ yard wide? *Ans.* 4 $\frac{1}{2}$ yards.

DOUBLE RULE of THREE,
in VULGAR FRACTIONS.

EXAMPLES.

- I**F a carrier receives £2 $\frac{1}{10}$ for the carriage of 5 cwt. 150 miles, how much ought he to receive for the carriage of 9 cwt. 2 qrs. $\frac{1}{2}$. 50 miles? *Ans.* £1..6..11. $\frac{1}{4}$.
2. If £100 in 12 months gain £5 interest, what principal will gain £3. $\frac{1}{4}$ in 9 months? *Ans.* £90.
3. If 7 students spend £7 $\frac{3}{4}$ in 14 days, how much will 21 students spend in 35 days? *Ans.* £57..17..1. $\frac{1}{2}$.
4. A man and his wife having laboured one day earned 4s. $\frac{3}{4}$, how much must they have for 5 $\frac{1}{2}$ day when their two sons help them? *Ans.* £2..5..11. $\frac{1}{4}$.
5. If £50 in 7 months gain £3 $\frac{1}{2}$, what time will £15 $\frac{1}{2}$ require to gain £3 $\frac{1}{10}$? *Ans.* 22. $\frac{2}{3}$ months.
6. If the carriage of 50 cwt. 15 miles cost £7 $\frac{1}{10}$, what weight can I have carried 30 miles for £5 $\frac{1}{10}$? *Ans.* 17 cwt. 3 qr. 16 lb.

THE NEW TUTOR'S ASSISTANT.

PART III.

DECIMAL FRACTIONS.

IN Decimal Fractions the integer or whole thing, as one pound, one yard, one gallon, &c. is supposed to be divided into ten equal parts, and those parts into tenths, and so on without end.

So that the denominator of a decimal, being always known to consist of an unit with as many cyphers as the numerator has places, is never set down; the parts being only distinguished from the whole numbers by a comma prefixed; thus, .5 which stands for $\frac{5}{10}$, .25 for $\frac{25}{100}$, .123 for $\frac{123}{1000}$.

But the different value of figures appears plainer by the following table.

Whole numbers.

Decimal parts.

7	6	5	4	3	2	1	2	3	4	5	6	7
Millions.	C ^t thousands.	X ^t thousands.	Thousands.	Hundreds.	Tens.	Units.	Parts of Tens.	Parts of Hundreds.	Parts of thousands.	Parts of X ^t thousands.	Parts of C ^t thousands.	Parts of Millions.

From which it plainly appears, that, as whole numbers increase in a ten-fold proportion to the left-hand, decimal parts

parts decrease in a ten-fold proportion to the right-hand: so that cyphers placed before decimal parts decrease their value, by removing them farther from the comma, or unit's place; thus, $.5$ is 5 parts of 10, or $\frac{5}{10}$; $.05$ is 5 parts of 100, or $\frac{5}{100}$; $.005$ is 5 parts of 1000, or $\frac{5}{1000}$; $.0005$ is 5 parts of 10000, or $\frac{5}{10000}$. But cyphers after decimal parts do not alter their value. For $.5$, $.50$, $.500$, &c. are each but $\frac{5}{10}$ of the unit.

A **FINITE DECIMAL** is that which ends at a certain number of places; but an **INFINITE** is that which no where ends.

A **RECURRING DECIMAL** is that wherein one or more figures are continually repeated, as 35.313333

And 45.352352352 is called a **COMPOUND RECURRING DECIMAL**.

Note. A finite decimal may be considered as infinite, by making cyphers to recur; for they do not alter the value of the decimal.

In all operations, if the result consists of several nines, reject them, and make the next superior place an unit more; thus for, 37.35999 write 37.36 .

In all circulating numbers, dash the first figure; thus, in $59.37\dot{6}66$.

ADDITION of DECIMALS.

RULE. The points of all under each other place,
Then like whole numbers you may add the case;
From sum cut off as many figures mind
As in the longest decimal you find.

EXAMPLES.

1. Add $251971 + 31,215 + 271,054 + 362,4 + 7,5$.

Facit 697,240.

2. Add $7,35 + 327,052 + 2597,3047 + 3,071$.

3. Add $257,012 + 2,59 + 36,2014 + 41,9251$.

4. Add $7,101 + 27,5943 + 3,9 + 27,4125 + 2,01$.

5. Add $7104,27 + 3,7104 + 25,93 + 37,214$.

6. Add $54 + 3,249 + 331 + 9,257 + 6,25$.

SUBTRACTION of DECIMALS.

RULE. As in Addition.

EXAMPLES.

- | | |
|----------------------------|----------------------------|
| 1. From .275 take .1254 | 5. From .257 take .3704 |
| 2. From 3.12 take 2.7104 | 6. From 25.04 take 7.259 |
| 3. From 7.14 take 2.714 | 7. From 621.04 take 3.7104 |
| 4. From 73.049 take 21.048 | 8. From 57.27 take 6.57105 |

MULTIPLICATION of DECIMALS.

RULE. As in whole numbers let the factors stand,
So multiply them too, from the right hand
Cut off as many figures with due care
(For decimals) as in both factors are
Should not so many in the product be;
The rest with noughts at the left hand supply.

EXAMPLES.

- | | |
|------------------------------|----------------------------|
| 1. Multiply .3974 by .40576 | 7. Multiply 725 by 2.374 |
| 2. Multiply 3.05 by 2.374 | 8. Multiply 2714 by 9.214 |
| 3. Multiply 47.12 by 31.0259 | 9. Multiply 724 by 17046 |
| 4. Multiply 3.351 by 6.394 | 10. Multiply 37.5 by .0049 |
| 5. Multiply 65.2 by 37.205 | 11. Multiply 4214 by .0035 |
| 6. Multiply 7325 by .37205 | |

When any decimals are to be done
By tens, an hundred, thousand, and so on,
Remove the point in the multiplicand
So many places towards the right hand
As you find noughts in multiplier stand.

$$.4673 \times 10 = 4.673, \quad .4673 \times 100 = 46.73.$$

$$.4673 \times 1000 = 467.3$$

Contracted MULTIPLICATION of DECIMALS.

RULE. First let the multiplier's units stand
Under such place of the multiplicand
As you'd in product keep; the others lay
Backwards, contrary to the usual way,
Begin with that place of multiplicand
Which over that you work withall doth stand,

110 Division of Decimals. The New Tutor's

The former figures of each product must
Under each other stand, then as is just
To the increase, which from the right doth come,
Pay due regard, and take into the sum.

EXAMPLES.

12. Multiply 475.2704 by 25.925, and let there be only two places of decimals.

Contracted way.

$$\begin{array}{r} 475.2704 \\ 259.52 \\ \hline 950541 \\ 237635 \\ 42774 \\ 950 \\ 238 \\ \hline 12321.38 \end{array}$$

Common way.

$$\begin{array}{r} 475.2704 \\ 25.925 \\ \hline 23763520 \\ 9505408 \\ 42774336 \\ 23763520 \\ 9505408 \\ \hline 12321.385000 \end{array}$$

13. Multiply 3.141592 by 52.7438, and leave only 4 places of decimals. *Facit 165.6994.*

14. Multiply 2.38645 by 8.2175, and leave only 4 places of decimals. *Facit 19.6107.*

15. Multiply 375.13758 by 16.7324, and let there be only 1 place of decimals. *Facit 6276.9.*

16. Multiply 375.13758 by 16.7324, and leave only 4 places of decimals. *Facit 6276.9520.*

17. Multiply 395.3756 by 75642, and let there be only 4 places of decimals. *Facit 299.0699.*

DIVISION of DECIMALS.

RULE. If dividend and divisor agree
In having equal decimals, you'll see
The quotient-always will whole numbers be. }
When'er more places in divisor lie,
The want in dividend with noughts supply,
Until they both are equal, and no more,
And then the quote's whole numbers as before.
But if in parts the dividend exceed
Divisor, then with quotient thus proceed;
Let just as many decimals remain
As one above the other doth contain.
If not so many in the quote appear,
Put cyphers to the left with proper care.

EXAMPLES.

EXAMPLES.

1. Divide 85643,825 by 5,321. *Facit 13549.*
2. Divide 487 by 144.
3. Divide 217,75 by 65.
4. Divide 125 by 1045.
5. Divide 709 by 2,101.
6. Divide 5,215 by 3,1761.
7. Divide 7421,54 by 2,5676.
8. Divide 76215 by 32,1476.
9. Divide 47,125 by 36,104.
10. Divide 725,217 by 7194.
11. Divide 473,43 by 375,2071.

When numbers are to be divided by 10, 100, 1000, 10,000, &c. it is performed by placing the separating point in the dividend, so many places towards the left-hand, as there are cyphers in the divisor.

Thus, $6254 \div 10 = 625,4$ $6254 \div 1000 = 6,254.$
 $6254 \div 100 = 62,54$ $6254 \div 10000 = ,6254.$

Contracted DIVISION of DECIMALS.

RULE. The worth of the first quotient figure find
 By former rules, and knowing it, then mind
 The decimals with ease you may reduce
 To any number, if you do but use
 As many places in the dividend
 As of whole numbers quote, doth comprehend,
 But mind to omit in working each time one
 Of the divisors figures till they're done.

EXAMPLES.

12. Divide 476,2172 by 2,325742, and let there be only three places of decimals in the quotient.

Contracted.

Common way.

$ \begin{array}{r} 2,325742 \overline{) 476,2172} \\ \underline{4651484} \\ 110688 \\ \underline{93029} \\ 17659 \\ \underline{16280} \\ 1379 \\ \underline{1163} \\ 216 \\ \underline{185} \\ 31 \end{array} $	$ \begin{array}{r} 2,325742 \overline{) 476,2172} \\ \underline{4651484} \\ 11068800 \\ \underline{9302968} \\ 17658320 \\ \underline{16280194} \\ 13781260 \\ \underline{11628710} \\ 21525500 \\ \underline{18605936} \\ 2919664 \end{array} $
--	---

L 2

13. Divide

112 Reduction of Decimals. The New Tutor's

13. Divide 8,71085 by 3,259254.
14. Divide 14,27152 by 6,37418.
15. Divide 271,0415 by 71925.
16. Divide 72154 by 32715.
17. Divide 7634 by 2,7104.
18. Divide 25974 by 371039.

REDUCTION of DECIMALS.

To reduce a Vulgar Fraction to a Decimal.

RULE. To ~~now~~ add cyphers, and by ~~den~~
Divide, you'll find the answer then.

EXAMPLES.

1. Reduce $\frac{1}{2}$ - - - to a decimal. *Facit* 500,000,125.
2. Reduce $\frac{1}{4}$ - - - to a decimal. *Facit* 25.
3. Reduce $\frac{1}{5}$ - - - to a decimal. *Facit* 5.
4. Reduce $\frac{1}{10}$ - - - to a decimal. *Facit* .75.
5. Reduce $\frac{1}{20}$ - - - to a decimal. *Facit* .375.
6. Reduce $\frac{1}{3}$ - - - to a decimal. *Facit* .625.
7. Reduce $\frac{1}{4}$ of $\frac{1}{2}$ - - - to a decimal. *Facit* .375.

NOTE. If you divers denominations see
In given parts, they may reduced be
By just so many workings, or reduce
Them to the lowest name you have in use,
Then as before divide, the answer you'll produce.

When even shillings be the case,
Take half for decimals first place,
With farthings the two next supply
That in the pence and farthings be;
To add one to them always mind,
When more than twenty-five you find.
If shillings odd should be the case,
By five increase the second place.

8. Reduce 5s. to the decimal of a £. *Facit* .25.
9. Reduce 7s. to the decimal of a £. *Facit* .35.
10. Reduce 14s. to the decimal of a £. *Facit* .7.
11. Reduce 7s. 4d. to the decimal of a £. *Facit* .3666.
12. Reduce 15s. 7d. $\frac{3}{4}$ to the decimal of a £. *Facit* .78229.

first.

first.	second.	third.
20 15s. 7d. $\frac{1}{2}$.	4)300	2)15
12 12	12)7.75	,782
240 187	20)15,6483	
4 4		
960)751(.78229+	,7822915	

13. Reduce 5s. 6d. $\frac{1}{2}$ to the decimal of a £.

Facit ,277083+.

14. Reduce 18 drams to the decimal of a lb. avoirdupoise.

Facit ,0703125+.

15. Reduce 3 grs. 14 lb. to the decimal of an cwt.

Facit ,875.

16. Reduce 12 grains to the decimal of a lb. troy.

Facit ,002083+.

17. Reduce 3 furlongs to the decimal of a league.

Facit ,125.

18. Reduce 3 quarts, 1 pint, to the decimal of a gallon.

Facit ,875.

19. Reduce 3 gallons, 1 quart of beer, to the decimal of a barrel.

Facit ,090277+.

20. Reduce 46 days to the decimal of a year.

Facit ,12602+.

21. Reduce 4 bushels, 3 pecks, to the decimal of a chaldron.

Facit ,13195+.

22. Reduce 5 gallons, 2 quarts of wine, to the decimal of an hoghead.

Facit ,087301+.

23. Reduce 1 rood, 30 poles, to the decimal of an acre.

Facit ,4375.

24. Reduce 3 gallons $\frac{1}{2}$ to the decimal of a kilderkin of beer.

Facit ,2083+.

To find the value of any Decimal Fraction, in the known Parts of an Integer.

RULE. By so many parts the fraction multiply
As doth in next denomination lie,
Cut off the whole numbers you in product find,
And multiply whate'er is left behind
By next denomination, so go on,
Unto the lowest name, and then 'tis done.

L 3

EXAMPLES.

114 Reduction of Decimals. The New Tutor's

EXAMPLES.

25. What is the value of ,78229 of a £. *Ans.* 15s. 7d. $\frac{1}{2}$.

$$\begin{array}{r} 20 \\ \hline 15,64580 \\ 12 \\ \hline 7,74960 \\ 4 \\ \hline \end{array}$$

3,99840

26. What is the value of ,277008 of a £.?

Ans. 5s. 6d. $\frac{1}{2}$.

27. What is the value of ,07031 of a lb. avoirdupois?

Ans. 1 oz. 1 dr.

28. What is the value of ,875 of an cwt.?

Ans. 3 qrs. 14 lb.

29. What is the value of 0020833 of a lb. troy?

Ans. 12 grs. nearly.

30. What is the value of ,125 of a league?

Ans. 3 furlongs.

31. What is the value of ,875 of a gallon?

Ans. 3 quarts, 1 pint.

32. What is the value of ,090277 of a barrel of beer?

Ans. 3 gall. 1 quart, nearly.

33. What is the value of ,12602 of a year?

Ans. 46 days, nearly.

34. What is the value of ,13195 of a chaldron?

Ans. 4 bushels, 3 pecks.

35. What is the value of ,087301 of a hoghead of wine?

Ans. 5 gall. 2 quarts, nearly.

36. What is the value of ,4375 of an acre?

Ans. 1 rood, 30 poles.

37. What is the value of ,2083 of a kilderkin?

Ans. 3 gall. 3 quarts, nearly.

Decimal

Decimal TABLES of COIN, WEIGHT and MEASURE.

TABLE I.
ENGLISH COIN.
£ the Integer.

Sb.	dec.	Sb.	dec.
19	,95	9	,45
18	,9	8	,4
17	,85	7	,35
16	,8	6	,3
15	,75	5	,25
14	,7	4	,2
13	,65	3	,15
12	,6	2	,1
11	,55	1	,05
10	,5	11	,55

Pence.	Decimals.
6	,025
5	,020833
4	,016666
3	,0125
2	,008333
1	,004166

Farthings.	Decimals.
3	,003125
2	,0020833
1	,0010416

TABLE II.
ENG. COIN. 1 Sb.
Long Meas. 1 Foot
the Integer.

Pence and Inches	Decimals.
6	,5
5	,416666
4	,333333
3	,25
2	,166666
1	,083333

Farthings.	Decimals.
3	,0625
2	,041666
1	,020833

TABLE III.
TROY WEIGHT.
1 lb the Integer.
*Ounces the same as
Pence in the last
Table.*

Penny- weights.	Decimals.
10	,041666
9	,0375
8	,033333
7	,029166
6	,025
5	,020833
4	,016666
3	,0125
2	,008333
1	,004166

Grains.	Decimals.
12	,002083
11	,001910
10	,001736
9	,001562
8	,001389
7	,001215
6	,001042
5	,000868
4	,000694
3	,000521
2	,000347
1	,000173

1 Oz. the Integer.
*Penny-weights the same
as Shillings in the first
Table.*

Grains.	Decimals.
12	,025
11	,022916
10	,020833
9	,01875
8	,016666
7	,014583
6	,0125
5	,010416
4	,008333
3	,00625
2	,004166
1	,002083

TABLE IV.
AVOIRDUPOIS WT.
112 lb. the Integer.

Qrs.	Decimals.
3	,75
2	,5
1	,25

Pounds.	Decimals.
14	,125
13	,116671
12	,107143
11	,098214
10	,089286
9	,080357
8	,071428
7	,0625
6	,053571
5	,044643
4	,035714
3	,026786
2	,017857
1	,008928

Ounces.	Decimals.
8	,004464
7	,003906

Decimal TABLES of COIN, WEIGHT, and MEASURE.

6	,003348	80	,317460	<i>Pints.</i>	<i>Decimals</i>
5	,002790	70	,27	3	,005952
4	,002232	60	,238095	2	,003968
3	,001674	50	,198412	1	,001984
2	,001116	40	,158730		
1	,000558	30	,119047		

$\frac{1}{2}$ Oz.	<i>Decimals</i>
3	,000418
2	,000279
1	,000139

TABLE V. Avoirdupois. Wt. 1 lb. the Integer.

<i>Ounces.</i>	<i>Decimals</i>
8	,5
7	,4375
6	,375
5	,3125
4	,25
3	,1875
2	,125
1	,0625

<i>Drams.</i>	<i>Decimals</i>
8	,03125
7	,027343
6	,023437
5	,019531
4	,015625
3	,011718
2	,007812
1	,003906

TABLE VI. LIQUID MEAS. 1 Tan the Integer.

<i>Gallons.</i>	<i>Decimals</i>
100	,396825
90	,357141

20	,079365
10	,039682
9	,035714
8	,031746
7	,027
6	,023809
5	,019841
4	,015873
3	,011904
2	,007936
1	,003968

<i>Pints.</i>	<i>Decimals</i>
4	,001984
3	,001488
2	,000992
1	,000496

A Hoghead the Integer.

<i>Gallons.</i>	<i>Decimals</i>
30	,476190
20	,317460
10	,158730
9	,142857
8	,126984
7	,111111
6	,095238
5	,079365
4	,063492
3	,047619
2	,031746
1	,015873

TABLE VII. MEASURE *Liquid. Dry.*

1 Gallon, 1 Quarter Integer.

<i>Pints.</i>	<i>Decim.</i>	<i>Bush.</i>
4	,5	4
3	,375	3
2	,25	2
1	,125	1

$\frac{1}{2}$ pt.	<i>Decim.</i>	<i>Peck</i>
3	,09375	3
2	,0625	2
1	,03125	1

<i>Decimals.</i>	$\frac{1}{2}$ Pks.
,0234375	3
,015625	2
,0078125	1

<i>Decimals.</i>	<i>Pints.</i>
,005859	3
,003906	2
,001953	1

TABLE VIII. LONG MEASURE 1 Mile the Integer.

<i>Yards.</i>	<i>Decimals.</i>
1000	,568182
900	,511364
800	,454545
700	,397727
600	,340909

Decimal TABLES of CORN, WEIGHT, and MEASURE

500	,284091	80	,219178
400	,227272	70	,191781
300	,170454	60	,164383
200	,113636	50	,136986
100	,056818	40	,109589
90	,051136	30	,082192
80	,045454	20	,054794
70	,039773	10	,027397
60	,034091	9	,024657
50	,028409	8	,021918
40	,022727	7	,019178
30	,017045	6	,016438
20	,011364	5	,013698
10	,005682	4	,010959
9	,005114	3	,008219
8	,004545	2	,005479
7	,003977	1	,002739
6	,003409		
5	,002841		
4	,002273		
3	,001704		
2	,001136		
1	,000568		

Day the Integer.

Hours.	Decimals
12	,5
11	,458333
10	,416666
9	,375
8	,333333
7	,291666
6	,25
5	,208333
4	,166666
3	,125
2	,083333
1	,041666

Feet.	Decimals
2	,0003787
1	,0001894

Inches.	Decimals
6	,0000947
3	,0000474
1	,0000158

TABLE IX.
TIME.
Year the Integer.
Months the same as
Pence in the second
Table.

Days.	Decimals
365	1,000000
300	,821918
200	,547945
100	,273973
90	,246575

Minutes.	Decimals
30	,020833
20	,013888
10	,006944
9	,00625
8	,005555
7	,004861
6	,004166
5	,003472
4	,002777
3	,002083
2	,001388
1	,000694

TABLE A.
CLOTH MEASURE.
Yard the Integer.
Qrs. the same as
Table 4.

Nails.	Decimals.
2	,125
1	,0625

TABLE XI.
LEAD WEIGHT.
Pound the Integer.

Hund.	Decimals
10	,512820
9	,461338
8	,410256
7	,358974
6	,307692
5	,256410
4	,205128
3	,153846
2	,102564
1	,051282

Qrs.	Decimals.
2	,025641
1	,012820

Pounds.	Decimals.
14	,0064102
13	,0059523
12	,0054945
11	,0050366
10	,0045787
9	,0041208
8	,0036630
7	,0032051
6	,0027472
5	,0022893
4	,0018315
3	,0013736
2	,0009157
1	,0004578

The RULE of THREE in DECIMALS.

EXAMPLES.

1. IF $26\frac{1}{2}$ yards cost £3..16..3. what will $32\frac{1}{2}$ yards cost?

Yds.	£	Yds.
26,5	3,8125	32,25
	32,25	

$$26,5)122,953125(4,63974=£4..12..9\frac{1}{2}$$

2. If I gave 1s. 1d. for $3\frac{1}{2}$ lb. of cheese, what will be the value of 1 cwt.?

Ans. £1..14..8.

3. If 1 cwt. of currants cost £2..9..6. what will 45 cwt. 3 quarters, 14 lb. cost, at the same rate?

Ans. £113..10..9 $\frac{1}{2}$.

4. What will the pay of 540 men come to at £1..5..6. per man?

Ans. £688..10..—.

5. Bought 29 lb. 4 oz. of coffee for £10..11..3. what is the value of 3 lb.?

Ans. £1..1..8.

6. Bought a tankard for £10..12..— at the rate of 5s. 4d. per ounce, what was the weight?

Ans. 39 oz. 15 dwt.

7. If $7\frac{1}{2}$ yards of cloth cost £2..12..9. what will 140 $\frac{1}{2}$ yards of the same cost?

Ans. £47..16..3. 2, 4 qrs.

8. If 1 ounce of silver cost 5s. 6d. what is the price of a tankard that weighs 1 lb. 10 oz. 10 dwt. 4 grs.?

Ans. £6..3..9. 2, 2 qrs.

9. If a chest of sugar, weighing 7 cwt. 2 qrs. 14 lb. cost £36..12..9. what will 2 cwt. 1 qr. 21 lb. of the same cost?

Ans. £11..14..2. 3, 5 qrs.

10. If 1 lb. of tobacco cost 15d. what will 3 hogheads come to, weighing together 15 cwt. 1 qr. 19 lb.

Ans. £107..18..10.

11. A grocer buys 24 ton, 12 cwt. 2 qrs. 14 lb. 12 oz. of tobacco for £3678..6..4. what will 1 ounce come to?

Ans. 1d.

12. Gave £187..3..3. for 25 cwt. 3 qrs. 14 lb. of tobacco, at what rate did I buy it at per lb.?

Ans. 15d. 2 qrs.

13. What will 326 lb. $\frac{1}{2}$ of tobacco come to, when 1 $\frac{1}{2}$ lb. is sold for 3s. 6d.?

Ans. £38..11..3.

14. What is the worth of 827 $\frac{1}{2}$ yards of painting at 10d. $\frac{1}{2}$ per yard?

Ans. £36..4..3. 1, 5 qrs.

15. Bought

15. Bought 6 chests of sugar, each 6 cwt. 3 qrs. at £2..16..-. per cwt. what do they come to?

Ans. £113..8..-

16. What is the worth of 19 oz. 3 dwt. 5 grs. of gold, at £2..19..-. per ounce?

Ans. £36..10..52,999r.

17. If I lent my friend £34. for $\frac{1}{2}$ of a year, how much ought he to lend me $\frac{1}{2}$ of a year to requite my kindness?

Ans. £51.

18. If $\frac{1}{2}$ of a yard of cloth, that is 2 yards $\frac{1}{2}$ broad, make a garment, how much, that is $\frac{1}{3}$ of a yard wide, will make the same?

Ans. 2,109 $\frac{3}{5}$ yards.

EXTRACTION of the SQUARE ROOT.

EXTRACTING the Square Root is to find out such a number as being multiplied into itself, the product will be equal to the given number.

RULE. First point the figure on the unit's place,
And place a point on ev'ry other space;
The left-hand period then take, and find
The greatest square that it contains, and mind
Subtract the square, the root a quotient make;
To what remains another period take
Let twice the quote as a divisor be;
To the resolvend without units, see
How oft it may be found, the answer true
Put to the quotient, and divisor too,
Division make, to what remains bring down
Next period if you have one, and go on.

ROOTS.	1.	2.	3.	4.	5.	6.	7.	8.	9.
SQUARES.	1.	4.	9.	16.	25.	36.	49.	64.	81.

EXAMPLES.

1. What is the square root of 60516? *Ans.* 246.

60516(246

4

44)205

176

486)2916

2916

2. What

120 Rule of Three in Decimals. The New Tutor's

2. What is the square root of 125316? *Ans.* 354.
3. What is the square root of 3076516? *Ans.* 1754.
4. What is the square root of 7612081? *Ans.* 2759.
5. What is the square root of 13140625? *Ans.* 3625.
6. What is the square root of 32558436? *Ans.* 5706.

When the given number consists of a whole number, and decimals together, make the number of decimals even, by adding cyphers to them; so that there may be a point fall on the unit's place of the whole number.

7. What is the square root of 2058,4069? *Ans.* 45,37.
8. What is the square root of 92459,173041? *Ans.* 304,071.
9. What is the square root of 5,73794816? *Ans.* 2,3104.
10. What is the square root of 9,455625? *Ans.* 3,075.
11. What is the square root of 2,03776247? *Ans.* 1,4275+.
12. What is the square root of 329529,959756? *Ans.* 574,047+.

To extract the Square Root of a Volgar Fraction.

RULE. The fraction to its lowest terms reduce,
Extract the root of *den*, which you must use
For a new *den*, the root of *num* then take
For a new *num*, and thus the answer make.

Note. If the fraction be a surd, (i.e.) a number where a root can never be exactly found, reduce it to a decimal, and extract the root from it.

EXAMPLES.

13. What is the square root of $\frac{3109}{1171}$? *Ans.* $\frac{3}{1}$.
14. What is the square root of $\frac{9163}{1111}$? *Ans.* $\frac{2}{1}$.
15. What is the square root of $\frac{9163}{1111}$? *Ans.* $\frac{2}{1}$.

SURDS.

16. What is the square root of $\sqrt{74}$? *Ans.* 8,5301+.
17. What is the square root of $\sqrt{71}$? *Ans.* 8,3299+.
18. What is the square root of $\sqrt{78}$? *Ans.* 8,8446+.

To extract the Square Root of a mixed Number.

RULE. Unto a simple fraction first reduce
The number given, and then by the use
Of the last rule, the answer you'll produce. }

Note. If the mixed number be a surd, reduce the fractional part to a decimal, annex it to the whole number, and extract the square root therefrom.

EXAMPLES.

ASSISTANT. *Extraction of the Square Root.* 121

EXAMPLES.

19. What is the square root of $10\frac{6}{3}$? *Facit* $3\frac{1}{3}$.
 20. What is the square root of $18\frac{7}{9}$? *Facit* $4\frac{1}{3}$.
 21. What is the square root of $6\frac{1}{4}$? *Facit* $2\frac{1}{2}$.

SURDS.

22. What is the square root of $27\frac{1}{4}$? *Facit* $5,2535$.
 23. What is the square root of $38\frac{1}{4}$? *Facit* $6,1846$.
 24. What is the square root of $51\frac{3}{4}$? *Facit* $7,1647$.

The APPLICATION.

25. There is an army consisting of a certain number of men, who are placed rank and file, (that is, in the form of a square, each side having 375 men) I desire to know the number of men contained therein? *Ans.* 140625.

26. A certain pavement is made exactly square, each side of which contains 59 feet, I demand how many square feet are contained therein? *Ans.* 3481.

To find a mean proportional between any two given numbers.

RULE. The product of the given numbers take,
 Extract the root of it, the mean 'twill make.

27. What is the mean proportional between 6 and 24?

Ans. 12.

28. What is the mean proportional between 72 and 288.

Ans. 144.

To find the side of a square equal in area to any given superficies.

RULE. Find the content of superficies true,
 Extract the root of it, the side you'll view.

EXAMPLES.

29. If the content of a circle be 320, what is the side of the square? *Ans.* 17,8885.

30. If the area of a circle is 841, what is the side of the square equal? *Ans.* 29.

The area of a circle given to find the diameter.

RULE. Three hundred and fifty a first term make,
 Four hundred fifty-two for second take;
 The area given, then the third should be,
 And in the fourth the answer's square you'll see.

M

EXAMPLE.

222 Extraction of the Squ. Root. The NEW TUTOR'S

EXAMPLE.

31. What length of cord will be fit to tie to a cow's tail, the other end fixed in the ground, to let her have liberty of eating an acre of grass and no more, supposing the cow and tail to be 5 yards $\frac{1}{2}$? *Ans.* 6,136 perches.

The area of a circle given to find the periphery or circumference.

RULE. Eleven and three-tenths a first term make,
One hundred forty-two for second take;
The area given, then the third should be
The fourth, the square of the periphery.

EXAMPLES.

32. When the area is 24, what is the circumference? *Ans.* 17,3652.

33. When the area is 320, what is the periphery? *Ans.* 63,41323.

Any two sides of a right angled triangle given to find the third side.

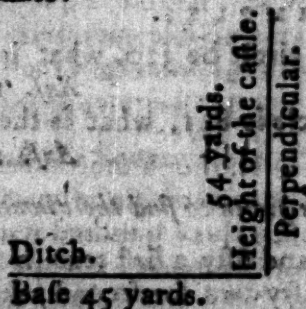
N. B. *The longest side is called the hypotenuse, the other two sides legs.*

The two legs given to find the hypotenuse.

RULE. The sum of both the squares of the legs take,
The root of which hypotenuse will make.

EXAMPLES.

34. The top of a castle from the ground is 54 yards high, and surrounded with a ditch 45 yards broad; what length must a ladder be to reach from the outside of the ditch to the top of the castle? *Ans.* 70,2922.



35. The walls of a town is 34 feet high, which is surrounded by a moat 30 feet in breadth. I desire to know the length

ASSISTANT. *Extraction of the Cube Root.* 123

length of a ladder that will reach from the outside of the moat to the top of the wall. *Ans.* 45, 3431.

The hypotenuse and one leg given to find the other.

RULE. Square both the given numbers, then subtract
The less from greater, afterwards extract
Root of what remains, th' answer'll be exact. }

N.B. *The last two questions may be varied for examples to the last propositions.*

Any number of men being given to form them into a square battle, or to find the number of ranks and files.

RULE. What is the square root of the number see,
That is the number, rank, or file will be.

36. An army consisting of 140025 men, how many rank and file? *Ans.* 375.

37. A certain square pavement contains 3481 square stones, all of a size, I demand how many are contained in one of the sides? *Ans.* 59.

EXTRACTION *of the* CUBE ROOT.

TO extract the Cube Root is to find out a number, which being multiplied into itself, and then into that product, produceth the given number.

RULE. First point the figure in the unit's place,

And put a point on every third space;

The left-hand period then take, and find

The greatest cube that it contains, and mind

Subtract the cube, the root a quotient make,

To what remains another period take;

Take tens and units from resolvend, see

If thrice the quotient's square divisor be.

How oft it may be found in resolvend

Put it to quote, and for a subtrahend;

Call the last figure *a*, the first you may

Call *a*, and then three hundred *a a a*

More thirty *aa*, more *aa*

A proper subtrahend you'll find will be,

Which from resolvend take, and then bring down

Another period, and so go on.

M 2

Roots.

124 Extraction of the Cube Root. The New Tutor's

ROOTS. 1. 2. 3. 4. 5. 6. 7. 8. 9.
CUBES. 1. 8. 27. 64. 125. 216. 343. 512. 729.

EXAMPLE.

1. What is the cube root of 16974593?

16974593(251

8 = cube of 2

Divisor. —

Square of $2 \times 3 = 12$ 8974 resolvend.

125 = cube of 5.

150 = $2 \times 3 \times$ by square of 5.

60 = divisor $\times$ by 5.

7625 subtrahend.

Divisor. —

Square of $25 \times 3 = 1875$ 1349593 resolvend.

343 = cube of 7.

3675 = $25 \times 3 \times$ by square of 7.

13125 = divisor $\times$ by 7.

1349593 subtrahend.

EXAMPLES.

1. What is the cube root of 16974593?

Square of $2 \times 3 = 12$ divisor.

Square of 5 put to 12 = 1225

$5 \times 3 \times 2 = 30$

$1525 \times 5 =$

Square of $25 \times 3 = 1875$

Square of 7 = 49 put to 1875 = 187549

$7 \times 3 \times 25 = 525$

$192799 \times 7 = 1349593$

2. What is the cube of 27? Ans. 19683.

3. What is the cube of 274? Ans. 20570824.

4. What is the cube of 2,61? Ans. 17,779581.

5. What is the cube of 37,5? Ans. 52734,375.

6. What is the cube of 2194? Ans. 10,656,117,384.

When the quotient is 2 or 3, there must be a cypher put to supply the place of tens.

7. What

ASSISTANT. *Extraction of the Cube Root.* 125

7. What is the cube root of 19683? *Ans.* 27.
8. What is the cube root of 20570824? *Ans.* 274.
9. What is the cube root of 17,779581? *Ans.* 2,61.
10. What is the cube root of 52734,375? *Ans.* 37,5.
11. What is the cube root of 010561117384? *Ans.* ,2194.
12. What is the cube root of 673373097125? *Ans.* 8765.

When the given number consists of a whole number and decimal together, make the number of decimals consist of 3, 6, 9, &c. places by adding cyphers thereto, so that there may be a point fall on the unit's place of the whole number.

13. What is the cube root of 16,974593? *Ans.* 2,57.
14. What is the cube root of 46850,670125? *Ans.* 36,05.
15. What is the cube root of 20,346417? *Ans.* 2,73.
16. What is the cube root of 92836,605952? *Ans.* 45,28.
17. What is the cube root of 15926,972504? *Ans.* 25,16+.
18. What is the cube root of 33,230979637? *Ans.* 3,215+.

To extract the Cube Root of a Vulgar Fraction.

RULE. The fraction to its lowest term reduce,
Find the cube root of *den*, which you may use
For a new *den*; of *num* the cube root take
For a new *num*, and thus the answer make.

EXAMPLES.

19. What is the cube root of $\frac{720}{1440}$? *Ans.* $\frac{2}{3}$.
20. What is the cube root of $\frac{140}{2500}$? *Ans.* $\frac{1}{5}$.
21. What is the cube root of $\frac{1500}{1125}$? *Ans.* $\frac{2}{3}$.

RULE. If ever surds your given fraction are,
Reduce them unto decimals with care,
Extract their root, the answer will appear.

SUMMARY.

22. What is the cube root of $\frac{1}{8}$? *Ans.* ,7539+.
23. What is the cube root of $\frac{1}{27}$? *Ans.* ,763+.
24. What is the cube root of $\frac{1}{125}$? *Ans.* ,693+.

To extract the Cube Root of a mixed Number.

RULE. To an improper fraction first reduce
The number given, and then by the use
Of the last rule the answer you'll produce.

When you a surd the given number find,
Turn fraction to a decimal, and mind

126 Extraction of the Cube Root. The New Tutor's

Annex it to whole number, then extract
The root of both; the answer'll be exact.

EXAMPLES.

25. What is the cube root of $5\frac{104}{125}$? *Ans.* $1\frac{4}{5}$.
26. What is the cube root of $12\frac{19}{27}$? *Ans.* $2\frac{1}{3}$.
27. What is the cube root of $31\frac{13}{21}$? *Ans.* $3\frac{1}{7}$.

SURDS.

28. What is the cube root of $8\frac{2}{3}$? *Ans.* $2,06+$.
29. What is the cube root of $10\frac{1}{4}$? *Ans.* $2,16+$.
30. What is the cube root of $8\frac{1}{4}$? *Ans.* $2,057+$.

The APPLICATION.

31. If a cubical piece of timber be 54 inches long, 54 inches broad, and 54 inches deep, how many cubical inches doth it contain? *Ans.* 157464.

32. There is a cellar dug, that is 15 feet every way in length, breadth, and depth; how many solid feet of earth were taken out of it? *Ans.* 3375.

33. There is a stone of a cubic form, which contains 157464 solid feet, what is the superficial content of one of its sides? *Ans.* 2916.

Between two numbers given, to find two mean proportionals.

RULE. First by the less the great extreme divide,
The cube root of that *quote* when multiply'd
By less extreme, the less mean will provide;
By the said root the less mean multiply,
And you'll procure the greater mean thereby.

EXAMPLES.

34. What are the two mean proportionals between 8 and 216? *Ans.* 24 and 72.
35. What are the two mean proportionals between 9 and 243? *Ans.* 27 and 81.

To find the side of a cube that shall be equal in solidity to any given solid, as a globe, cylinder, prism, cone, &c.

RULE. First find the true content whate'er it be,
Extract its cube-root, and the side you'll see.

EXAMPLE.

EXAMPLE.

36. If the solid content of a globe is 157464, what is the side of a cube of equal solidity? *Ans.* 54.

The side of the cube being given, to find the side of the cube that shall be double, treble, &c. in quantity to the cube given.

RULE. Cube the side given, and then multiply
By what'er number may in question lie,
Cuberoot of that sum the answer'll supply.

EXAMPLE.

37. There is a cubical vessel, whose side is 15 inches, and it is required to find the side of another vessel, that is to contain three times as much? *Ans.* 21,63.

EXTRACTING of the BIQUADRATE ROOT.

TO extract the Biquadrate Root is to find out a number which being involved four times into itself will produce the given number.

RULE. What is the *square* root of the number see,
And then the *root* of that the answer'll be.

EXAMPLES.

1. What is the biquadrate of 25? *Ans.* 390625.
2. What is the biquadrate of 84? *Ans.* 49787136.
3. What is the biquadrate of 246? *Ans.* 3662186256.
4. What is the biquadrate root of 390625? *Ans.* 25.
5. What is the biquadrate root of 49787136? *Ans.* 84.
6. What is the biquadrate root of 3662186256? *Ans.* 246.

A general RULE for EXTRACTING the ROOTS of all POWERS.

RULE. By rules before, to *point* your numbers mind,
And by same rules the *root's* first figure find,
Subtract as usual, and to what's behind
One place of next succeeding *period* take,
And that a proper *dividend* will make.

Involve

228 Extract of Root of Powers. The Tutor's

Involve the root in power next in name
 Below that giv'n, then multiply the same
 By given pow'r, let it divisor be,
 A quotient figure by division see,
 Annex it to the root, involve it all
 Into the power given, and that call
 A subtrahend, then by subtraction take
 It from the two first periods, and make
 Whate'er remains with just one figure more
 Another dividend, proceeding as before.

EXAMPLES.

1. What is the square root of 204304?

$$\begin{array}{r}
 204304(452 \\
 \underline{16} \qquad 4 \times 2 = 8 \text{ divisor.} \\
 45 \times 45 = 2025 \text{ subtrahend.} \\
 8)44 \text{ dividend.} \quad 45 \times 2 = 90 \text{ divisor.} \\
 \underline{} \quad 452 \times 452 = 204304 \text{ subtrahend.} \\
 2025 \text{ subtrahend.} \\
 \underline{45 \times 2 = 90} 180 \text{ dividend.} \\
 \underline{2025} \text{ subtrahend.}
 \end{array}$$

2. What is the cube root of 92345408(452?

$$\begin{array}{r}
 92345408(452 \\
 \underline{64} \\
 48)283 \text{ dividend.} \\
 \underline{91125} \text{ subtrahend.} \\
 4075)12209 \text{ dividend.} \\
 \underline{92345408} \text{ subtrahend.}
 \end{array}$$

$$\begin{array}{l}
 4 \times 4 \times 3 = 48 \text{ divisor.} \\
 45 \times 45 \times 45 = 91275 \text{ subtrahend.} \\
 45 \times 45 \times 3 = 6075 \text{ divisor.} \\
 452 \times 452 \times 452 = 92345408 \text{ subtrahend.}
 \end{array}$$

3. What

3. What is the biquadrate root of 41740124416?

$$\begin{array}{r} 41740124416(452 \\ 256 \end{array}$$

256)1614 dividend.

4100625 subtrahend.

364500)733874 dividend.

$$\begin{array}{r} 41740124416 \end{array}$$

$$4 \times 4 \times 4 \times 4 = 256 \text{ divisor.}$$

$$45 \times 45 \times 45 \times 45 = 4100625 \text{ subtrahend.}$$

$$45 \times 45 \times 45 \times 4 = 364500 \text{ divisor.}$$

$$452 \times 452 \times 452 \times 452 = 41740124416 \text{ subtrahend.}$$

SIMPLE INTEREST.

THERE are five things to be observed in Simple Interest, *viz.*

P, the Principal.

T the Time.

R the Ratio, or rate per cent.

I the Interest.

A the Amount.

A TABLE OF RATIOS.

Rates per cent.	Deci- mals.	Rates per cent.	Deci- mals.	Rates per cent.	Deci- mals.
3	,03	5½	,055	8	,08
3½	,035	6	,06	8½	,085
4	,04	6½	,065	9	,09
4½	,045	7	,07	9½	,095
5	,05	7½	,075	10	,1

NOTE. The Ratio is the Simple Interest of £1. for one year, at the Rate per Cent. proposed, and is found thus:

$$\begin{array}{l} \text{£.} \quad \text{£.} \quad \text{£.} \\ \text{As } 100 : 3 :: 1 : ,03. \end{array} \quad \begin{array}{l} \text{As } 100 : 3,5 :: 1 : ,035. \\ \text{When} \end{array}$$

130 Simple Interest.

The New Tutor's

When the principal, time, and rate per cent. are given to find the interest.

RULE. Multiply the principal, time, and rate per cent. together, it will give the interest.

NOTE. The proposition and rule are better expressed thus:

I. When P, T, R, are given to find I.

RULE. $\text{prt} = \text{I}$.

NOTE. When two or more letters are put together like a word, they are to be multiplied one into another.

EXAMPLES.

1. What is the interest of £475..10.. at 5 per cent. per annum, for 4 years?

$$475.5 \times .05 \times 4 = 95.1, \text{ or } £95..2..$$

2. What is the interest of £537..16.. for 6 years, at $4\frac{1}{2}$ per cent. per annum? *Ans.* £145..4..1. 1 qr. 76.

3. What is the interest of £393..17..6. for three years and $\frac{1}{2}$, at $3\frac{1}{2}$ per cent. per annum? *Ans.* £48..2..6. 2 qrs. 076.

4. What is the interest of £856..5..6. at 6 per cent. per annum, for 3 years, 5 months? *Ans.* £175..10..8.

5. What is the interest of £359..14.. for $2\frac{1}{2}$ years, at $3\frac{1}{2}$ per cent. per annum? *Ans.* £34..12..5. 07.

6. What is the interest of £1059..18..9. for 3 years, 8 months, at $4\frac{1}{2}$ per cent. per annum?

$$\text{Ans. } £127..3..2, 2 \text{ qrs. } 2738.$$

When the interest is for any number of days only.

RULE. Multiply the interest of £1. for 1 day, at the given rate, by the principal and number of days, it will give the answer.

INTEREST OF £1. FOR ONE DAY.

per cent.	Decimals.	per cent.	Decimals.
3	,00008219178	$6\frac{1}{2}$	,00017808219
$3\frac{1}{2}$	,00009589041	7	,00019178082
4	,00010958904	$7\frac{1}{2}$	,00020547945
$4\frac{1}{2}$	,00012378767	8	,00021917808
5	,00013698630	$8\frac{1}{2}$	,00023287671
$5\frac{1}{2}$	,00015068493	9	,00024657534
6	,00016438356	$9\frac{1}{2}$	,00026027397

NOTE. The above table is thus found:

$$\text{As } 365 : .03 :: 1 : .00008219178, \text{ And as } 365 : .035 :: 1 : .00009589041.$$

EXAMPLES.

7. What is the interest of £250. for 130 days, at $3\frac{1}{2}$ per cent. per annum?

Ans. £3..2..3 $\frac{1}{2}$. 780.

$$.00009589041 \times 250 \times 130 = 3.11643825.$$

8. What is the interest of £478..18.. for 125 days, at 9 per cent. per annum?

Ans. £8..4.. 006847.

9. What is the interest of £550..15.. at 6 per cent. per annum, for 255 days?

Ans. 23..1..8 $\frac{1}{2}$.

10. What is the interest of £439..7..6. for 59 days, at 4 per cent. per annum?

Ans. £2..16..9 $\frac{1}{2}$.

11. What is the interest of £345..18.. for 66 days, at $5\frac{1}{2}$ per cent. per annum?

Ans. 3..8..9 $\frac{1}{2}$.

12. What is the interest of £250. from the 1st of March, 1780, to the 5th of August following, at $\frac{1}{2}$ per cent. per annum?

Ans. £5..7..6. 4109.

II. When P, R, T, are given to find A.

RULE. $prt + p = A$.

EXAMPLES.

13. What will £355..14.. amount to in 5 years, at $3\frac{1}{2}$ per cent. per annum?

Ans. £417..18..A1 $\frac{1}{4}$. 6.

$$355.7 \times .035 \times 5 = 417.9475.$$

14. What will £460..17.. amount to in 7 years, at 5 per cent. per annum?

Ans. £622..2..11 $\frac{1}{2}$. 4.

15. What will £658..12..6. amount to in 6 years, at $4\frac{1}{2}$ per cent. per annum?

Ans. £836..9..0 $\frac{1}{2}$. 6.

When there is any odd time given with the whole years, reduce the odd time into days, and work with the decimal parts of a year which are equal to those days.

16. What will £950..18.. amount to in 5 years $\frac{1}{2}$, at 5 per cent. per annum?

Ans. £1212..7..11 $\frac{1}{2}$. 6.

17. What will £367..15.. amount to in 6 years $\frac{1}{2}$, at $4\frac{1}{2}$ per cent. per annum?

Ans. £479..9.. $\frac{1}{2}$. 9.

18. What will £257..18.. amount to in 5 years, 165 days, at $3\frac{1}{2}$ per cent. per annum?

Ans. £307..2..3. 1117.

III. When A, R, T, are given to find P.

RULE. $\frac{a}{rt + 1} = P$.

$rt + 1$.

19. What principal, being put to interest, will amount to £417..18..11. 1,6 qrs. in 5 years, at $3\frac{1}{2}$ per cent. per ann.?

$$.035 \times 5 + 1 = 1.175. \text{ then } 417.9475 \div 1.175 = £355..14..$$

20. What

20. What principal, being put to interest, will amount to £622..2..11. 2,4 *qrs.* in 7 years, at 5 per cent. per annum?

Ans. £460..17..-

21. What principal, being put to interest, will amount to £836..9..- 3,6 *qrs.* in 6 years, at $4\frac{1}{2}$ per cent. per annum?

Ans. £658..12..6.

22. What principal, being put to interest, will amount to £1212..7..11. 1,6 *qrs.* in $5\frac{1}{2}$ years, at 5 per cent. per ann.?

Ans. £950..18..-

23. What principal, being put to interest, will amount to £479..9..0. 3,9 *qrs.* in 6 years $\frac{1}{2}$, at $4\frac{1}{2}$ per cent. per ann.?

Ans. 367..15..-

24. What principal, being put to interest, will amount to £307..2..3. 1117. in 5 years, 165 days, at $3\frac{1}{2}$ per cent. per annum?

Ans. £257..18..-

IV. *When A, P, T, are given to find R.*

a-p.

RULE.—=R.

pt.

25. At what rate per cent. will £355..14..- amount to £417..18..11. 1,6 *qrs.* in 5 years?

Ans. $417.9475 - 355.7 \div 355.7 \times 5 = .035$ or $3\frac{1}{2}$ per cent.

26. At what rate per cent. will £460..17..- amount to £622..2..11. 2,4 *qrs.* in 7 years? *Ans.* 5 per cent.

27. At what rate per cent. will £658..12..6. amount to £836..9..- 3,6 *qrs.* in 6 years? *Ans.* $4\frac{1}{2}$ per cent.

28. At what rate per cent. will £950..18..- amount to £1212..7..11. 1,6 *qrs.* in $5\frac{1}{2}$ years? *Ans.* 5 per cent.

29. At what rate per cent. will £367..15..- amount to £479..9..0. 3,9 *qrs.* in 6 years $\frac{1}{2}$? *Ans.* $4\frac{1}{2}$ per cent.

30. At what rate per cent. will £257..18..- amount to £307..2..3. 1117. in 5 years, 165 days?

Ans. $3\frac{1}{2}$ per cent.

V. *When A, P, R, are given to find T.*

a-p.

RULE.—=T.

pr.

31. In what time will £355..14..- amount to £417..18..11. 1,6 *qrs.* at $3\frac{1}{2}$ per cent.?

Ans. $417.9475 - 355.7 \div 355.7 \times .035 = 5$ years.

32. In

32. In what time will £460..17..-. amount to £622..2..11.
2,4 qrs. at 5 per cent. ? *Ans. 7 years.*
33. In what time will £658..12..6. amount to £836..9..-:
3,6 qrs. at $4\frac{1}{2}$ per cent. ? *Ans. 6 years.*
34. In what time will £950..18..-. amount to £1212..7..11.
1,6 qrs. at 5 per cent. ? *Ans. $5\frac{1}{2}$ years.*
35. In what time will £367..15..-. amount to £479..9..0.
3,9 qrs. at $4\frac{1}{2}$ per cent. ? *Ans. 6 years $\frac{3}{4}$.*
36. In what time will £257..18..-. amount to £307..2..3.
1117 qrs. at $3\frac{1}{2}$ per cent. ? *Ans. 5 years, 165 days.*

ANNUITIES or PENSIONS, &c. in Arrears.

Annuities or Pensions, &c. are said to be in arrears when they are payable or due, either yearly, half-yearly, or quarterly, and are unpaid for any number of payments.

NOTE. U represents the annuity, pension, or yearly rent. T, R, A, as before.

I. When U, R, T, are given to find A.

$$tu - tu$$

$$\text{RULE.} \frac{tu - tu}{2} \times r : + tu = A.$$

2

EXAMPLES.

37. If a salary of £140. be forborne 5 years, at 5 per cent. what will it amount to? *Ans. £770.*

$$5 \times 5 \times 140 - 5 \times 140 \div 2 = 1400 \text{ then } 1400 \times .05 + 5 \times 140 = £770.$$

38. If a yearly pension of £230. be forborne 6 years, what will it amount to at $4\frac{1}{2}$ per cent. ?

$$\text{Ans. } £1535..5..-$$

39. There is a house let upon lease for 7 years, at £50. per annum, what will be the amount for the whole time at $4\frac{1}{2}$ per cent. ?

$$\text{Ans. } £397..5..-$$

40. Suppose an annual pension of £50. remain unpaid for eight years, what would it amount to at 5 per cent. ?

$$\text{Ans. } £470.$$

Note. When the annuities, &c. are to be paid half-yearly or quarterly, then

For half-yearly payments, take half the ratio, half the annuity, &c. and twice the number of years—and,

For quarterly payments, take a fourth part of the ratio, a fourth part of the annuity, &c. and four times the number of years, and work as before.

N

41. If

41. If a salary of £140. payable every half-year, remains unpaid for 5 years, what would it amount to in that time at 5 per cent.?

Ans. £778..15..—.

42. If a salary of £140. payable every quarter, was left unpaid for 5 years, what would it amount to in that time, at 5 per cent.?

Ans. £783..2..6.

NOTE. It may be observed by comparing these last examples, the amount of the half-yearly payments are more advantageous than the yearly, and the quarterly than the half-yearly.

II. When A, R, T, are given to find U.

2a

RULE. ——— = U.

11r—1r+2t.

43. If a salary amounted to £770 in 5 years, at 5 per cent, what was the salary?

Ans. £140.

$$770 \times 2 = 1540. \quad 5 \times 5 \times .05 = 5 \times .05 + 5 \times 2 = £140.$$

44. If a house is to be let upon lease for 7 years, and the amount for that time be £397..5..—, at $4\frac{1}{2}$ per cent. what is the yearly rent?

Ans. £50.

45. If a pension amounted to £1535..5..—, for 6 years, at $4\frac{1}{2}$ per cent. what is the pension?

Ans. £230.

46. Suppose the amount of a pension be £470. in 8 years, at 5 per cent. what is the pension?

Ans. £50.

NOTE. When the payments are half-yearly, then take 4 a, half the ratio, and twice the number of years; and if quarterly, take 8 a, one-fourth of the ratio, and four times the number of years, and proceed as before.

47. If the amount of a salary, payable half-yearly for 5 years, and at 5 per cent. be £778..15..—, what is the salary?

Ans. £140.

48. If the amount of an annuity, payable quarterly, be £783..2..6. for 5 years, at 5 per cent. what is the annuity?

Ans. £140.

III. When U, A, T, are given to find R.

2a—2ut

RULE. ——— = R.

ut—ut.

49. If a salary of £140. per annum amount to £770. in 5 years, what is the rate per cent.?

Ans. 5 per cent.

140

$$770 \times 2 = 1540 \quad 140 \times 5 \times 2 = 140 \text{ then } 140 \times 5 \times 5 = 140 \times 5 = .05$$

50. If an house is let upon lease for 7 years at £50. per annum, and the amount for that time be £397..5..-. what is the rate per cent.?

Ans. $4\frac{1}{2}$ per cent.

51. If a pension of £230. per ann. amount to £1535..5..-. for 6 years, what is the rate per cent.?

Ans. $4\frac{1}{2}$ per cent.

52. Suppose the amount of a yearly pension of £50. per annum be £470. in 8 years, what is the rate per cent.?

Ans. 5 per cent.

NOTE. When the payments are half-yearly, take 4a—4ut for a dividend, and work with half the annuity, and double the number of years for a divisor; if quarterly, take 8a—8ut, and work with a fourth of the annuity, and four times the number of years.

53. If a salary of £140. per annum, payable half-yearly, amounts to £778..15..-. in 5 years, what is the rate per cent.?

Ans. 5 per cent.

54. If an annuity of £140. per annum, payable quarterly, amount to £783..2..6. in 5 years, what is the rate per cent.?

Ans. 5 per cent.

IV. When U, A, R, are given to find T.

RULE. $\frac{2}{r} - 1 = x$ then $\sqrt{\frac{2a \times x}{ur} + \frac{x}{2}} = T$.

EXAMPLES.

55. In what time will a salary of £140. per ann. amount to £770. at 5 per cent.?

$$\begin{array}{r} \frac{2}{,05} - 1 = 39. \quad \frac{770 \times 2}{140 \times ,05} = 220. \quad \frac{39 \times 39}{4} = 380,25 \\ \sqrt{220 + 380,25} = 24,5 - \frac{39}{2} = 5 \text{ years.} \end{array}$$

56. If an house is let upon lease, for a certain time, for £50. per annum, and the amount be £397..5..-. at $4\frac{1}{2}$ per cent. what time was it let for?

Ans. 7 years.

57. If a pension of £230. per ann. amounts to £1535..5..-. at $4\frac{1}{2}$ per cent. what was the time of forbearance?

Ans. 6 years.

58. In what time will a yearly pension of £50. amount to £470. at 5 per cent.?

Ans. 8 years.

N 2

NOTE.

NOTE. If the payments are half-yearly, take half the ratio and half the annuity; if quarterly, one-fourth of the ratio and one fourth of the annuity; and T will be equal to those half-yearly or quarterly payments.

59. If an annuity of £140. per annum, payable half-yearly, amounts to £778..15..-. at 5 per cent. what time was the annuity forborne? *Ans. 5 years.*

60. If a yearly pension of £140. payable quarterly, amounts to £783..2..6. at 5 per cent. what was the time of forbearance? *Ans. 5 years.*

Present Worth of ANNUITIES.

Note. P represents the present worth; U, T, R, as before.

$$\text{RULE. } \frac{11r - 1r + 2t}{21r + 2} : X :: P.$$

61. What is the present worth of £140. per annum, to continue 5 years, at 5 per cent.?

$$\frac{5 \times 5 \times .05 - 5 \times .05 + 5 \times 2}{5 \times .05 \times 2 + 2} : X :: 140 = £616.$$

62. What is the yearly rent of an house of £50, to continue 7 years, worth in ready money at $4\frac{1}{2}$ per cent.?

Ans. £302..1..9. 2, 4 grs.

63. What is the present worth of £230. per annum, to continue 6 years, at $4\frac{1}{2}$ per cent.? *Ans. £1208..17..1..68.*

64. What is a pension of £50. per annum, worth in ready money at 5 per cent. for 8 years? *Ans. £335..14..2..4.*

Note. The same thing is to be observed as in the first rule of annuities in arrears, concerning half-yearly and quarterly payments.

65. What is the present worth of £140. per annum, payable half-yearly for five years, at 5 per cent.? *Ans. £623.*

66. What is the present worth of £140. per annum, payable quarterly for 5 years, at 5 per cent. per annum? *Ans. £626..10..-.*

Note. By comparing the last examples it will be found, that the present worth of half-yearly payments is more advantageous than yearly; and quarterly than half-yearly.

II. When

II. When P, T, R, are given to find U.

RULE. $\frac{tr+1}{tr-tr+2t} : \times 2p = U.$

67. If the present worth of a salary be £616. to continue 5 years, at 5 per cent. what was the salary?

$$\frac{5 \times .05 + 1}{5 \times 5 \times .05 - 5 \times .05 + 5 \times 2} \times 616 \times 2 = £140.$$

68. There is a house let upon lease for 7 years to come, I desire to know the annual rent, when the present worth at $4\frac{1}{2}$ per cent. is £302..1..9. 2,4 qrs. *Ans.* £50.

69. What annuity is that which for 6 years continuance, at $4\frac{1}{2}$ per cent. produces £1208..17..7, 2 qrs. present worth? *Ans.* £230.

70. What annuity is that which for 8 years continuance produces £335..14..3. 2,4 qrs. for the present worth at 5 per cent.? *Ans.* £50.

Note. When the payments are half-yearly, take half the ratio, twice the number of years, and multiply by 4 p; and when quarterly, take one-fourth of the ratio, four times the number of years, and multiply by 8 p.

71. There is an annuity, payable half-yearly, for 5 years to come, what is the yearly rent, when the present worth, at 5 per cent. is £623. *Ans.* £140.

72. There is an annuity, payable quarterly, for 5 years to come, I desire to know the yearly income, when the present worth, at 5 per cent. is £626..10..-. *Ans.* £140.

III. When U, P, T, are given to find R.

RULE. $\frac{ut - p \times 2}{2pt + ut - utt} = R.$

EXAMPLES.

73. At what rate per cent. will an annuity of £140. per annum, to continue 5 years, produce the present worth of £616? *Ans.* 5 per cent.

$$\frac{140 \times 5 - 616 \times 2}{140 \times 5 \times 5} = .05$$

N 3

74. If

74. If a yearly rent of £50. to continue 7 years, produces £302..1..9. 2,4. for the present worth, what is the rate per cent.?

Ans. $4\frac{1}{2}$ per cent.

75. If an annuity of £230. to continue 6 years, produce £1208..17..-. 7,2. for the present worth, what is the rate per cent.?

Ans. $4\frac{1}{2}$ per cent.

76. If a pension of £50. to continue 8 years, produces £335..14..3. 2,4. for the present worth, what is the rate per cent.?

Ans. 5 per cent.

Note. When the annuities, or rents, &c. are to be paid half-yearly or quarterly, then

For half-yearly payments, take half of the annuity, &c. and twice the number of years, the quotient will be the ratio of half the ratio per cent.—and,

For quarterly payments, take a fourth part of the annuity, &c. and four times the number of years, the quotient will be the ratio of a fourth part of the rate per cent.

77. If an annuity of £140. per annum, payable half yearly, having 5 years to come, is sold for £623. what is the rate per cent.?

Ans. 5 per cent.

78. If an annuity of £140. per annum, payable quarterly, having 5 years to come, is sold for £626..10..-. what is the rate per cent.?

Ans. 5 per cent.

IV. When U, P, R, are given to find T.

$$\text{RULE. } \frac{2}{r} - \frac{2p}{u} - 1 = x \text{ then } \sqrt{\frac{2p}{ur} + \frac{xx}{4}} - \frac{x}{2} = T.$$

EXAMPLES.

79. If an annuity of £140. per annum produce £616. for the present worth, at 5 per cent. what is the time of its continuance?

Ans. 5 years.

$$\begin{array}{r} \frac{2}{.05} - \frac{616 \times 2}{140} - 1 = 30,2. \quad \frac{616 \times 2}{140 \times .05} = 176 \\ 30,2 \times 30,2 \\ \hline = 228,01 \text{ then } \sqrt{228,01} + 176 = 20,1 \\ 20,1 - \frac{30,2}{2} = 5 \text{ years.} \end{array}$$

80. For

80. For what time may a salary of £50. be purchased for £302..1..9. 2,4 qrs. at $4\frac{1}{2}$ per cent.? *Ans.* 7 years.

81. For how long time may £230. per annum be purchased at $4\frac{1}{2}$ per cent. when the present worth is £1208..17..7..2. *Ans.* 6 years.

82. What time may an income of £50. per annum be bought for, at 5 per cent. when the present worth is £335..14..3. 2,4 qrs.? *Ans.* 8 years.

Note. When the payments are half-yearly, then U will be equal to the half annuity, Sc. R half the ratio, and T the number of payments; and

When the payments are quarterly, U will be equal to a fourth part of the annuity, Sc. R the fourth of the ratio, and T the number of payments.

83. If an annuity of £140. per annum, payable half-yearly, is sold for £623. at 5 per cent. I desire to know the number of payments, and the time to come? *Ans.* 10 payments = 5 years.

84. An annuity of £140. per annum, payable quarterly, is sold for £626..10..-. at 5 per cent. what is the number of payments, and time to come? *Ans.* 20 payments = 5 years.

ANNUITIES, &c. taken in REVERSION.

1. To find the present worth of an annuity, Sc. taken in reversion.

RULE. Find the present worth of $1tr - tr + 2t$ the yearly sum at the given rate, and $\frac{1tr - tr + 2t}{2tr + 2} \times u = P$. for the time of its continuance, thus,

2. Change P into A, and find what principal being put to interest, will amount to A, at the same rate, and for the time to come before the annuity commences, thus, $\frac{a}{tr + 1} = P$.

EXAMPLES.

85. What is the present worth of an annuity of £140. per annum, to continue 5 years, but not to commence till the end of 4 years, allowing 5 per cent. to the purchaser?

$$\begin{array}{r} 5 \times 5 \times .05 - 5 \times .05 + 2 \times 5 \\ \hline = 4.4 \times 140 = 616 \\ 5 \times .05 \times 2 + 2 \\ \hline \pounds 513.6.7.3.96 \text{ qrs.} \end{array}$$

$$\begin{array}{r} 4 \times .05 + 1 \\ \hline 86. \text{ What} \end{array}$$

86. What is the present worth of a lease of £50. per annum, to continue 4 years, but is not to commence till the end of 5 years, allowing 4 per cent. to the purchaser?

Ans. £152..5..11. 2,8 qrs.

87. A person having the promise of an income of £50. per annum for 8 years, but not to commence till the end of 4 years, is willing to dispose of the same at 5 per cent. what will be the present worth?

Ans. £279..15..2. 3,424.

88. A legacy of £30. per annum being left for 6 years to a person of 15 years of age, but is not to commence till he is 21 years of age; he wanting money, is desirous of selling the same at 4 per cent. what is the present worth?

Ans. £128..15..5. ,28.

2. To find the yearly income of an annuity, &c. in reversion.

RULE 1. Find the amount of the present worth at the given rate, and $ptr + p = A$. for the time before the reversion, thus,

2. Change A into P, and find what annuity being sold will produce P at the same rate, and for the time of its continuance, $\frac{tr + 1}{itr - tr + 2t} \times 2p = U$. thus,

EXAMPLES.

89. A person having an annuity left him for 5 years, which does not commence till the end of 4 years, disposes of it for £513..6..7. 3,96 qrs. allowing 5 per cent. to the purchaser, what was the yearly income?

$$513,3333 \times 4 \times .05 + 513,3333 = 615,99996.$$

$$5 \times 5 \times .05 - 5 \times .05 + 5 \times 2 = .113636 \times 615,99996 \times 2 =$$

£150.

90. There is a lease of an house taken for 4 years, but not to commence till the end of 5 years, the lessee would sell the same for £152..5..11. 2,8. present payment, allowing 4 per cent. to the purchaser, what is the yearly rent?

Ans. £50.

91. A person having the promise of an income for 8 years, which does not commence till the end of 4 years, has disposed of the same for £279..15..2. 3,424. present money, allowing 5 per cent. to the purchaser, what was the present income?

Ans. £50.

92. There

92. There is a certain legacy left to a person of 15 years of age, which is to be continued for 6 years, but not to commence till he arises to the age of 21; he wanting money, sells the same for £128..15..5. 28. allowing 4 per cent. to the buyer, what was the annuity left him?

Ans. £30.

REBATE or DISCOUNT.

Note. S. represents the sum to be discounted, P, T, R, as before.

$$\text{RULE. } \frac{S}{1 + r} = P.$$

EXAMPLES.

1. What is the present worth of £257..10..-. to be paid 9 months hence, at 5 per cent. *Ans.* £248..3..10. 248.

$$\frac{257.5}{1.75 \times .05 + 1} = 248.3.10. 248.$$

2. What is the present worth of £375..10..-. due 7 months hence, at 5 per cent. ? *Ans.* £364..17..2. 0064.

3. What is the present worth of £775..5..6. due 5 months hence, at 4½ per cent. ? *Ans.* £761..00063.

4. How much ready money can I receive for a note of £55. due 15 months hence, at 5 per cent. ?

Ans. £51..15..3. 528d.

II. When P, T, R, are given to find S.

$$\text{RULE. } ptr + p = S.$$

EXAMPLES.

5. If the present worth of a sum of money, due 9 months hence, allowing 5 per cent. be £248..3..10. 248. what was the sum due ?

Ans. £257..10..-. .

$$248.1927 \times .75 \times .05 + 248.1927 = 257.10.-.$$

6. A person owing a certain sum, payable 7 months hence, agrees with the creditor to pay him down £364..17..2. 0064. allowing 5 per cent. for present payment, what was the debt ?

Ans. £375..10..-. .

7. A

142 Rebate or Discount. The New Tutor's

7. A person receives £761. 00063. for a sum of money due 5 months hence, allowing the debtor $4\frac{1}{2}$ per cent. for present payment, what was the sum due?

Ans. £775..5..6.

8. A person paid £51..15..3. 528. for a debt due 15 months hence, he being allowed 5 per cent. for the discount, how much was the debt?

Ans. £55.

III. S, P, T, are given to find R.

RULE. $\frac{s-p}{sp} = R.$

EXAMPLES.

9. At what rate per cent. will £257..10..- payable 9 months hence, produce £248..3..10. 248. for present payment?

Ans. .05 = 5 per cent.

$$257,5 - 248,1927 \div 248,1927 \times .75 = .05.$$

10. At what rate per cent. will £375..10..- payable 7 months hence, produce £364..17..2. 0064. for present payment?

Ans. 5 per cent.

11. At what rate per cent. will £775..5..6. payable 5 months hence, produce the present payment of £761. 00063.

Ans. $4\frac{1}{2}$ per cent.

12. At what rate per cent. will £55. payable 15 months hence, produce the present payment of £51..15..3. 3,84 grs.

Ans. 5 per cent.

IV. When S, P, R, are given to find T.

RULE. $\frac{s-p}{sp} = T.$

EXAMPLES.

13. The present worth of £257..10..- due for a certain time to come, is £248..13..5. 3,712 grs. at 5 per cent. in what time should the sum have been paid without any rebate?

Ans. 9 months.

$$\frac{257,5 - 248,1927}{248,1927 \times .05} = .75 = 9 \text{ months.}$$

14. The present worth of £375..10..- due for a certain time to come, is £364..17..2. 076d. at 5 per cent. in what time should the sum have been paid without any rebate?

Ans. 7 months.

15. A

15. A person receives £761. for £775..5..6. due at a certain time to come, allowing $4\frac{1}{2}$ per cent. discount; I desire to know in what time the debt should have been discharged without any rebate? *Ans. 5 months.*

16. I have received £51..15..3. 3;528 qrs. for a debt of £55. allowing the person 5 per cent. for prompt payment; I desire to know when the debt would have been payable without rebate? *Ans. 1 year, 3 months.*

EQUATION OF PAYMENTS.

To find the equated time for the payment of a sum of money, due at several times.

RULE. Find the present worth of each payment for its respective time, thus,

$$\frac{s}{tr+1} = P.$$

Add all the present worth together, then

$$tr+1$$

$$s-p=D.$$

$$d$$

and

$$\frac{d}{pr} = E.$$

1. A owes B £400. whereof £80. is to be paid at 3 months, £120. at 6 months, and £200. at 9 months; at what time may the whole debt be paid together, rebate being made at 5 per cent. ? *Ans. 6 months, 26 days.*

$$\begin{array}{r} 80 \qquad \qquad \qquad 120 \qquad \qquad \qquad 200 \\ \hline \frac{80}{1,0125} = 79,012345. \quad \frac{120}{1,025} = 117,07317. \quad \frac{200}{1,0375} = 192,779 \\ \hline \text{then } 400 - 79,012345 + 117,07317 + 192,779 = 11,143495 \\ \hline \frac{11,143495}{192,779} = 5,7365 = 6 \text{ months, } 26 \text{ days.} \end{array}$$

2. C owes D £600. whereof £150. is to be paid in 3 months, £150. at 4 months, and £300. at 6 months; but they agreeing to make but one payment of the whole, at the rate of 5 per cent. rebate, the true equated time is demanded? *Ans. 4 months, 22 days.*

3. E owes F £800. which is to be paid as follows, £200. down, £300. at the end of 10 months, and the rest at the end of 20 months; but they agreeing to make out one payment of the whole, rebate at 4 per cent. the true equated time is demanded? *Ans. 11 months, 1 day.*

COMPOUND

COMPOUND INTEREST.

THE initials made use of in Compound Interest are,

A the Amount.

P the Principal.

T the Time.

R the Ratio, being the amount of £1. for 1 year, at any given rate, which is thus found:

As 100 : 105 :: 1 : 1,05. As 100 : 105,5 :: 1 : 1,055.

A TABLE of the Amount of £1 for One Year.

Rates per cent.	Amts. of £1.	Rates per cent.	Amts. of £1.	Rates per cent.	Amts. of £1.
3	1,03	5½	1,055	8	1,08
3½	1,035	6	1,06	8½	1,085
4	1,04	6½	1,065	9	1,09
4½	1,045	7	1,07	9½	1,095
5	1,05	7½	1,075	10	1,1

A TABLE, shewing the amount of £1. for any number of years under 31, at 4 and 5 per cent. per annum.

Yrs.	4 Rates.	5	Yrs.	4 Rates.	5
1	1,04000	1,05000	16	1,87298	2,18287
2	1,08160	1,02500	17	1,94790	2,29201
3	1,12486	1,15762	18	2,02581	2,40661
4	1,16985	1,21550	19	2,10684	2,52695
5	1,21665	1,27628	20	2,19112	2,65329
6	1,26531	1,34009	21	2,27876	2,78596
7	1,31593	1,40710	22	2,36991	2,92526
8	1,36856	1,47745	23	2,46471	3,07152
9	1,42331	1,55132	24	2,56330	3,22509
10	1,48024	1,62889	25	2,66583	3,38635
11	1,53945	1,71033	26	2,77246	3,55567
12	1,60103	1,79585	27	2,88336	3,73345
13	1,66507	1,88564	28	2,99870	3,92012
14	1,73167	1,97993	29	3,11865	4,11613
15	1,80094	2,07892	30	3,24339	4,32194

Note: The above Table is thus made: As 100 : 105 :: 1 : 1,05. for the first year; then as 100 : 105 :: 1,05 : 1,025 second year.

I. When P, T, R, are given to find A.

RULE. $P \times r^T = A$.

EXAMPLES.

1. What will £220. amount to in 3 years time, at 5 per cent. per annum?

$$1,157625 \times 220 = £254..13..6. 2,4 \text{ grs.}$$

2. What will £250. amount to in 4 years, at 5 per cent. per annum?

$$\text{Ans. } £303..17..6. 1,5 \text{ grs.}$$

3. What will £400. amount to in 5 years, at 4 per cent. per annum?

$$\text{Ans. } £486..13..2. 2,7145 \text{ grs.}$$

4. What will £450. amount to in 4 years, at 5 per cent. per annum?

$$\text{Ans. } £566..19..6. 2,70576 \text{ grs.}$$

II. When A, R, T, are given to find P.

RULE. $\frac{A}{r^T} = P$.

EXAMPLES.

5. What principal, being put to interest, will amount to £254..13..6. 2,4 grs. in 3 years, at 5 per cent. per annum?

$$1,05 \times 1,05 \times 1,05 = 1,157625. \frac{254,6775}{1,157625} = 220$$

6. What principal, being put to interest, will amount to £303..17..6. 1,5 grs. in 4 years, at 5 per cent. per annum?

$$\text{Ans. } £250.$$

7. What principal, being put to interest, will amount to £486..13..2. 2,7145 grs. in 5 years, at 4 per cent. per annum?

$$\text{Ans. } £400.$$

8. What principal, being put to interest, will amount to £566..19..6. 2,70576 grs. in 4 years, at 5 per cent. per annum?

$$\text{Ans. } £450.$$

III. When P, A, T, are given to find R,

RULE. $\frac{A}{P} = r^T$
P

which being extracted, by the rules of extraction, (the time given to the question, shewing the power) will give R.

O

EXAMPLES.

EXAMPLES.

9. At what rate per cent. will £220. amount to £254..13..6. 2,4 grs. in 3 years?

254.6775

$\frac{254.6775}{220} = 1,157625$ the cube root of which (it being the third power) $= 1,05 = 5$ per cent.

10. At what rate per cent. will £250. amount to £303..17..6. 1,5 grs. in 4 years? *Ans. 5 per cent.*

11. At what rate per cent. will £400. amount to £486..13..2. 2,7145 grs. in 5 years? *Ans. 4 per cent.*

12. At what rate per cent. will £450. amount to £546..19..6. 2,70576 grs. in 4 years? *Ans. 5 per cent.*

IV. When P, A, R, are given to find T,

RULE. $\frac{a}{p} = r^t$

which being continually divided by R, till nothing remains, the number of those divisions will be equal to T.

EXAMPLES.

13. In what time will £220. amount to £254..13..6. 2,4 grs. at 5 per cent.?

254.6775

$\frac{254.6775}{220} = 1,157625$ $\frac{1,157625}{1,05} = 1,1025$ $\frac{1,1025}{1,05} = 1,05$

1,05

$\frac{1,05}{1,05} = 1$ the number of divisions being 3 = time sought.

14. In what time will £250. amount to £303..17..6. 1,5 grs. at 5 per cent.?

Ans. 4 years.

15. In what time will £400. amount to £486..13..2. 2,7145 grs. at 4 per cent.?

Ans. 5 years.

16. In what time will £450. amount to £546..19..6. 2,70576 grs. at 5 per cent.?

Ans. 4 years.

ANNUITIES, or PENSIONS, in ARREARS.

Note. U represents the annuity, pension, or yearly rent, A, R, T, as before.

A TABLE,

A TABLE, shewing the amount of £1. annuity for any number of years under 31, at 4 and 5 per cent. per annum.

Yrs.	4 Rates	5	Yrs.	4 Rates	5
1	1,00000	1,00000	16	21,82453	23,65749
2	2,04000	2,05000	17	23,69751	25,84036
3	3,12160	3,15250	18	25,64541	28,13238
4	4,24646	4,31012	19	27,67122	30,53900
5	5,41632	5,52563	20	29,77807	33,06565
6	6,63297	6,80191	21	31,96920	35,71925
7	7,89829	8,14200	22	34,24796	38,50521
8	9,21422	9,54910	23	36,61788	41,43047
9	10,58279	11,02656	24	39,08260	44,50199
10	12,00610	12,57789	25	41,64590	47,72709
11	13,48635	14,20678	26	44,31174	51,11345
12	15,02580	15,91712	27	47,08421	54,66912
13	16,62683	17,71298	28	49,96758	58,40258
14	19,29191	19,59863	29	52,96628	62,32271
15	20,02358	21,57856	30	56,08493	66,43884

Note, The foregoing table is made thus: take the first year's amount, which is £1. multiply it by 1,05 + 1 = 2,05 = second year's amount, which also multiply by 1,05 + 1 = 3,1525 = third year's amount.

I. When U, T, R, are given to find A.

RULE. $\frac{ur^t - u}{r - 1} = A$, or by the table thus:

Multiply the amount of £1 for the number of years, and at the rate per cent. given in the question, by the annuity, pension, &c. and it will give the answer.

EXAMPLES.

17. What will an annuity of £40. per annum, payable yearly, amount to in 5 years, at 4 per cent.?

$$1,05 \times 1,05 \times 1,05 \times 1,05 \times 40 = 48,62025 \text{ --- } 40.$$

$$= £172..8..1..2.$$

18. What will a pension of £50. per annum, payable yearly, amount to in 5 years, at 4 per cent.?

$$\text{Ans. } £270..16..3..87072d.$$

19. If a salary of £40. per annum, to be paid yearly, be forborne 6 years, at 5 per cent. what is the amount?

O 2

$$\text{Ans. } £272..1..6..363d.$$

20. If an annuity of £60. per annum, payable yearly, be omitted to be paid for ten years, at 4 per cent. what is the amount? *Ans.* £720..7..3. 84d.

II. *When A, R, T, are given to find U.*

ar—a
RULE. ——— = U.

r—1

EXAMPLES.

21. What annuity, being forborne 4 years, will amount to £172..8..1. 2d. at 5 per cent.?

$$172,405 \times 1,05 - 172,405 = £40.$$

$$1,05 \times 1,05 \times 1,05 \times 1,05 - 1$$

22. What pension being forborne 5 years will amount to £270..16..3. 3,87072d. at 4 per cent.?

Ans. £50.

23. What salary being omitted to be paid 6 years will amount to £272..1..6. 363d. at 5 per cent.?

Ans. £40.

24. If the payment of an annuity being forborne ten years amount to £720..7..3. 84d. at 4 per cent. what is the annuity?

Ans. £60.

III. *When U, A, R, are given to find T.*

ar + u + a
RULE. ——— = *r* which being continually divided by R, till nothing remains, the number of those divisions will be equal to T.

EXAMPLES.

25. In what time will £40. per annum amount to £172..8..1. 2d. at 5 per cent. for non-payment?

$$172,405 \times 1,05 + 40 - 172,405 = 1,21550625$$

which being continually divided by R, the number of those divisions will be = 4 years.

26. In what time will £90. per annum amount to £270..16..3. 3,87072d. allowing 4 per cent. for forbearance?

Ans. 5 years.

27. In what time will £40. per annum amount to £272..1..6. 363d. at 5 per cent.?

Ans. 6 years.

28. In what time will £60. per annum amount to £720..7..3. 84d. allowing 4 per cent. for forbearance of payment?

Ans. 10 years.

PRESENT

PRESENT WORTH OF ANNUITIES, PENSIONS, &c.

A TABLE shewing the present worth of £1 annuity for any number of years under 31, rebate at 4 and 5 per cent.

Yrs.	4	Rates	5	Yrs.	4	Rates	5
1	0,96153		0,95238	16	11,65229		10,83777
2	1,88609		1,85941	17	12,16566		11,27406
3	2,77509		2,72324	18	12,65929		11,68958
4	3,62989		3,54595	19	13,13393		12,08532
5	4,45182		4,32947	20	13,59032		12,46221
6	5,24213		5,07569	21	14,02915		12,82115
7	6,00205		5,78637	22	14,45111		13,16300
8	6,73274		6,46321	23	14,85684		13,48857
9	7,43533		7,10782	24	15,24696		13,79864
10	8,11089		7,72173	25	15,62207		14,09394
11	8,76047		8,30641	26	15,98276		14,37518
12	9,38507		8,86325	27	16,32958		14,64303
13	9,98564		9,39357	28	16,66306		14,89812
14	10,56312		9,89864	29	16,98371		15,14107
15	11,11838		10,37965	30	17,29203		15,37245

Note. The above table is thus made: divide £1 by 1,05 = .95238, the present worth of the first year, which ÷ 1,05 = .90703, added to the first year's present worth = 1,85941, the second year's present worth; then, .90703 ÷ 1,05 and the quotient added to 1,85941 = 2,72324, third year's present worth, &c.

I. When U, T, R, are given to find P.

RULE. $P = \frac{U}{R} \left(1 - \frac{1}{(1 + \frac{R}{100})^T} \right)$

Or, by the table, thus,

Multiply the present worth of £1. annuity for the time and rate per cent. given by the annuity, pension, &c. it will give the answer.

150 Compound Interest. The New Tutor's

EXAMPLES.

29. What is the present worth of an annuity of £40. per annum, to continue 7 years, at 4 per cent.?

Ans. £240..1..7. 824d.

$$\frac{40}{1.31593} = 30.3967. \quad 40 - 30.3967 = 9.6033. \quad \frac{9.6033}{1.04 - 1}$$

= 240..1..7. 824. By the table 6,00205 $\times$ 40 = 240,082.

30. What is the present worth of a pension of £50. per annum, to continue 8 years, at 5 per cent.?

Ans. £323..3..2. 4d.

31. What is the present worth of a salary of £40. per annum, to continue 7 years, at 4 per cent.?

Ans. £240..1..7. 5d.

32. What is the yearly rent of £60. per annum, to continue 5 years, at 5 per cent. per annum?

Ans. £259..15..4. 32d.

II. When P, T, R, are given to find U.

RULE. $\frac{pr^t \times r - pr^t}{r - 1} = U.$

EXAMPLES.

33. If an annuity be purchased for £240..1..7. 2d. to be continued 7 years, at 4 per cent. what is the annuity?

Ans. £40.

$$\frac{240.08 \times 1.04 - 240.08 \times 1.31593}{1.31593 - 1} = 40.$$

34. If the present payment of £323..3..2. 4d. be made for a salary, 8 years to come, at 5 per cent. what was the salary?

Ans. £50.

35. If the present payment of £240..1..7. 44d. were required for a pension 7 years to come, at 4 per cent. what is the pension?

Ans. £40.

36. If the present worth of an annuity, 5 years to come, be £259..15..4. 32d. at 5 per cent. what is that annuity?

Ans. £60.

III. When U, P, R, are given to find T.

RULE. $\frac{U}{p + \frac{U}{r} - pr} = T.$

which being continually divided by R, till nothing remains, the number of those divisions will be = T.

EXAMPLES.

EXAMPLES.

37. How long may a lease of £40. yearly rent be had for £240..1..7. 2d. allowing 4 per cent. to the purchaser?

Ans. 7 years.

$$\frac{40}{240,08 + 40 - 240,08 \times 1,04} = 1,315928 \text{ by being divided by } 1,04, \text{ will be equal to 7 divisions} = 7 \text{ years.}$$

38. If £323..3..2. 4d. is paid down for a lease of £50. per annum, at 5 per cent. how long is the lease purchased for?

Ans. 8 years.

39. If a house is let upon lease for £40. per annum, and the lessee makes present payment of £240..1..7. 4d. he being allowed 4 per cent. I demand how long the lease is purchased for?

Ans. 7 years.

40. For what time may a lease be purchased for, of £60. per annum, when present payment is made of £259..15..4. 32d. allowing 5 per cent.?

Ans. 5 years.

ANNUITIES, LEASES, &c. taken in REVERSION.

To find the present worth of annuities, leases, &c. taken in reversion.

RULE 1. Find the present worth of the annuity, &c. at the given rate, and $u - \frac{u}{r} = P$ for the time of its continuance; thus,

2. Change P into A, and find what principal, being put to interest, will amount to P at the same time, and for the time to come, before the annuity commences, which will be the present worth of the annuity, &c. thus,

EXAMPLES.

41. What is the present worth of a reversion of a lease of £40. per annum, to continue 5 years, but not to commence till the end of 3 years, allowing 5 per cent. to the purchaser?

Ans. £149..12..7.

$$\frac{40}{1,27628} = 31,34108 \quad \frac{40}{1,05 - 1} = 800 \quad \frac{800}{1,15762} = 682,1784 \quad \frac{682,1784}{1,15762} = 589,6$$

42. What is the present worth of a reversion of a lease of £70. per annum, to continue 7 years, but not to commence

mence till the end of 2 years, allowing 5 per cent. to the purchaser? *Ans.* £367..8..-

43. There is a lease of a house at £50. per annum, which is yet in being for 4 years, and the lessee is desirous to take a lease in reversion for 7 years, to begin when the old lease shall be expired, what will be the present worth of the said lease in reversion, allowing 5 per cent. to the purchaser? *Ans.* £238..-..6.

To find the yearly income of an annuity, &c. taken in reversion.

RULE. Find the amount of the present worth, at the given rate, and for the $pr' = A$. time before the annuity commences; *thus,*

Change A into P, and find what yearly rent being sold will produce P, at the same rate, and for the time of its continuance, which will be the yearly sum $pr' \times r - pr' = U$. *thus,*

EXAMPLES.

44. What annuity to be entered upon 3 years hence, and then to continue 5 years, may be purchased for £149..12..- at 5 per cent.? *Ans.* £40.

$$149.6 \times 1.15762 = 173.179952$$

$$173.179952 \times 1.27628 \times 1.05 = 221.026189$$

$$221.026189 - 1.15762 = 219.868569 = £40.$$

45. The present worth of a lease of an house is £367..8..- taken in reversion for 7 years, but not to commence till the end of 2 years, allowing the purchaser 5 per cent. what is the yearly rent? *Ans.* £70

46. There is a lease of an house in being for 4 years, and the lessee being minded to take a lease in reversion for 7 years, to begin when the old lease shall be expired, paid down £238..-..6. what was the yearly rent of the house, when the lessee was allowed 5 per cent. for present payment? *Ans.* £50.

Purchasing FREEHOLD or REAL ESTATES,

Is such as are bought to continue for ever.

I. When U, R, are given to find W.

RULE. $\frac{U}{R} = W$.

EXAMPLES.

EXAMPLES.

47. What is the worth of a freehold estate of £60. per annum, allowing 5 per cent. to the buyer?

60

$$\text{Ans. } \frac{60}{1,05-1} = £1200.$$

48. What is an estate worth, to continue for ever, of £150. per annum, allowing 4 per cent. to the buyer?

Ans. £3750.

49. If a freehold estate of £65. per annum be sold, what is the worth in present money, allowing the purchaser 5 per cent?

Ans. £1300.

II. When W, R, are given to find U.

RULE. $w \times r - 1 = U.$

EXAMPLES.

50. If a freehold estate is bought for £1200. and the allowance of 5 per cent. is made to the buyer, what is the yearly rent?

Ans. $1,05-1=,05. 1200 \times ,05 = £60.$

51. If an estate be sold for £3750. present money, and 4 per cent. allowed to the buyer, what is the yearly rent?

Ans. £150.

52. If a freehold estate is bought for £1300. present money, and an allowance of 5 per cent. be made to the buyer for the same, what is the yearly rent?

Ans. £65.

III. When W, U, are given to find R.

$w + u$

RULE. $\frac{w+u}{u} = R.$

53. If an estate of £50. per annum is bought for £1000. what is the rate per cent?

$1000 + 50$

$\frac{1000+50}{1000} = 1,05 = 5 \text{ per cent.}$

54. If a freehold estate of £150. per annum be bought for £3750. what was the rate per cent. allowed?

Ans. 4 per cent.

55. If an estate of £65. per annum is sold for £1300. what is the rate per cent. allowed?

Ans. 5 per cent.

Purchasing FREEHOLD ESTATES in REVERSION.

To find the worth of a freehold estate in reversion.

RULE. Find the worth of the yearly rent, thus, u

Change W into A, and find what principal, $\frac{u}{r-1} = W.$ being put to interest, will amount to A at the $r-1$

same rate, and for the time to come, before the estate commences, and that will be the worth of $\frac{a}{r} = P$. the estate in reversion.

EXAMPLES.

56. If a freehold estate of £50. per annum, to commence 4 years hence, is to be sold, what is it worth, allowing the purchaser 4 per cent. for present payment.

Ans. £1068..10..3. 13368.

$$\begin{array}{r} 50 \\ \hline 1.04 - 1 \\ \hline \end{array} = 1250. \text{ then } \begin{array}{r} 1250 \\ \hline 1.16985 \\ \hline \end{array} = 1068,513057$$

57. What is an estate of £150. per annum, to continue for ever, but not to commence till the end of 2 years, worth in ready money, allowing the purchaser 5 per cent.?

Ans. £2721..1..9. 2232d.

58. What is an estate of £250. per annum worth in ready money, to continue for ever, but not to commence till the end of 3 years, allowance being made at 4 per cent.?

Ans. £5556..4..11. 28d.

To find the yearly rent of an estate taken in reversion.

RULE. Find the amount of the worth of the estate, at the given rate and time before it commences;

thus, $wr = A$.

Change A into W, and find what yearly rent being sold will produce U, at the same rate,

thus, $wr \times r = wr$

which will be the yearly rent required. $\frac{wr}{r} = U$.

EXAMPLES.

59. If a freehold estate, to commence 4 years hence, is sold for £1068..10..3. 13368 *per cent.* allowing the purchaser 4 per cent. what is the yearly income?

$$\begin{array}{r} 1068,513057 \times 1,16985 = 1250 \\ \text{then } 1250 \times 1,04 \times 1,04 - 1300 \\ \hline 1,04 \\ \hline \end{array} = £50$$

60. A freehold estate is bought for £2721..1..9. 2232d. which does not commence till the end of 2 years, the buyer being allowed 5 per cent. for his money; I desire to know the yearly income? *Ans.* £150.

61. There is a freehold estate sold for £5556..4..11. 28d. but not to commence till the expiration of 3 years, allowing 4 per cent. to the purchaser; what is the yearly income?

Ans. £250.

REBATE or DISCOUNT

A TABLE shewing the present worth of £1. due any number of years, to commence under 31, rebate at 4 and 5 per cent.

Note. The following table is thus made: $1 \div 1.05 = .952381$ first year's present worth; and $.952381 \div 1.05 = .90703$ second year, and $.90703 \div 1.05 = .863838$ third year, &c.

Years.	4.	Rates	5	Years.	4	Rates	5
1	.961538	.952381		16	.333908	.328111	
2	.924556	.907030		17	.319373	.3136296	
3	.888996	.863838		18	.293628	.287926	
4	.854802	.822702		19	.274642	.2689734	
5	.821927	.783526		20	.256386	.2506889	
6	.790314	.746215		21	.238833	.2330942	
7	.759917	.710682		22	.221955	.2161849	
8	.730690	.676839		23	.205726	.2000571	
9	.702586	.644609		24	.190121	.1845067	
10	.675564	.613913		25	.175116	.1695302	
11	.649580	.584678		26	.160689	.1551240	
12	.624596	.556837		27	.146816	.141348	
13	.600573	.530321		28	.133477	.128093	
14	.577474	.505068		29	.120651	.115346	
15	.555264	.481017		30	.108318	.103037	

I. When S, T, R, are given to find P.

RULE. $\frac{S}{R^T} = P$.

EXAMPLES.

1. What is the present worth of £182.6..6. payable 4 years hence, at 5 per cent.?

Ans. £150.

182.325

$$1.05 \times 1.05 \times 1.05 \times 1.05 = 1.2155 \quad \frac{182.325}{1.2155} = £150.$$

2. If £316.6..6. 6d. be payable in 6 years time, what is the present worth, rebate being made at 4 per cent.?

Ans. £250.

3. There is a debt of £425.8..6. 12d. which is payable 4 years hence, but it is agreed to be paid in present money, what sum must the creditor receive, rebate being made at 5 per cent.?

Ans. £330.

II. When P, T, R, are given to find S.

RULE. $P \times R^T = S$.

156 Rebate or Discount. The NEW TUTOR'S

4. If a sum of money due 4 years hence produce £150. for the present payment, rebate being made at 5 per cent. what was the sum due? *Ans.* $150 \times 1.2155 = £182..6..6.$

5. If £250. be received for a debt, payable 6 years hence, and an allowance of 4 per cent. to the debtor, for present payment, what was the debt? *Ans.* £316..6..6d.

6. There is a sum of money due at the expiration of 4 years, but the creditor agrees to take £350. for present payment allowing 5 per cent. what was the debt? *Ans.* £425..8..6.

III. When S, P, R, are given to find T.

which being continually divided by R, till nothing remains, the number of these divisions will be equal to T.

EXAMPLES.

7. The present payment of £150. is made for a debt of £182..6..6. rebate at 5 per cent. in what time was the debt payable? *Ans.* 4 years.

$$\begin{array}{r} 182,325 \\ \underline{150} \\ 32,325 \end{array} = 1,2155 = 4 \text{ divisions.}$$

8. A person receives £250. now for a debt of £316..6..6d. rebate being made at 4 per cent. in what time was the debt payable? *Ans.* 6 years.

9. There is a debt of £425..8..6. due at a certain time to come, but 5 per cent. being allowed to the debtor for the present payment of £350. I desire to know what time the sum should have been paid without any rebate?

Ans. 4 years.

IV. When S, P, T, are given to find R.

which being extracted by the rules of extraction, (the time given in the question shewing the power) will be equal to R.

EXAMPLES.

10. A debt of £182..6..6. is due 4 years hence, but it is agreed to take £150. now, what is the rate per cent. the rebate is made at? *Ans.* 5 per cent.

$$\begin{array}{r} 182,325 \\ \underline{150} \\ 32,325 \end{array} = 1,2155 = 5 \text{ per cent.}$$

11. The present worth of £316..6..6d. payable 6 years hence, is £250. at what rate per cent. is the rebate made?

Ans. 4 per cent.

THE

THE
NEW TUTOR'S ASSISTANT.

PART IV.

DUODECIMALS:

OR, WHAT IS GENERALLY CALLED

Cross Multiplication, and squaring of Dimensions
by ARTIFICERS and WORKMEN.

RULE for multiplying DUODECIMALLY.

UNDER each name in the multiplicand
Let the same name of multiplier stand;
Then take the lowest name of upper row,
And multiply it by the feet below;
Divide by 12, and let remainder stay
Under the lowest place, take quote away
To the next name above, and so go on,
Till all the names in upper line are done;
Then take the primes, still working as before,
But mind to put the products one place more
To the right hand; the seconds must be two,
Then add all up, you'll find the answer true.

P

EXAMPLES.

EXAMPLES.

1. Multiply $7 \text{ f. } 6 \text{ in.}$ by $3 \text{ f. } 9 \text{ in.}$

Cross Multiplication. Practice. Duodecimals. Decimals.

7×6	$7 \text{ f. } 6 \text{ in.}$	$7 \text{ f. } 6 \text{ in.}$	$3 \text{ f. } 9 \text{ in.}$	3.75
3×9	3	3	$3 \text{ f. } 9 \text{ in.}$	7.5
$21 \text{ f. } 6 \text{ in.} = 7 \times 3$	$22 \text{ f. } 6 \text{ in.}$	$22 \text{ f. } 6 \text{ in.} \times 3$		1875
$1 \text{ f. } 6 \text{ in.} = 6 \times 3$	$3 \text{ f. } 9 \text{ in.}$	$5 \text{ f. } 7.6 \text{ in.} \times 9$		2625
$5 \text{ f. } 3 \text{ in.} = 7 \times 9$	$1 \text{ f. } 10.6 \text{ in.}$			
$4 \text{ f. } 6 \text{ in.} = 9 \times 9$		$28 \text{ f. } 1.6 \text{ in.}$		$28,125$
	$28 \text{ f. } 1.6 \text{ in.}$			

	f. in.	f. in.	f. in.
2. Multiply	8.6.	by 5. 9.	Facit 48.10.6.
3. Multiply	11.2.	by 4. 7.	Facit 51. 2.2.
4. Multiply	7.5.9.	by 2. 5.3.	Facit 18. 2.9.2.3.
5. Multiply	10.4.5.	by 7. 8.3.	Facit 79. 8.5.5.3.
6. Multiply	47.9.2.	by 32. 3.4.	Facit 1541.8.6.6.8.
7. Multiply	85.2.	by 29. 2.1	Facit 2484.0.4.
8. Multiply	175.8.	by 124. 6.	Facit 21870.6.
9. Multiply	247.5.	by 38. 5.	Facit 9504.11.1.
10. Multiply	104.9.	by 25. 8.	Facit 2688.7.
11. Multiply	257.6.3.	by 46. 4.2.	Facit 11935.4.6.0.6.
12. Multiply	25.9.	by 4. 10.	Facit 124.5.6.
13. Multiply	49.3.	by 25. 8.	Facit 1264.1.
14. Multiply	127.6.	by 49. 4.	Facit 6290.
15. Multiply	218.7.	by 57. 3.	Facit 12513.10.9.
16. Multiply	314.9.4.	by 29. 7.6.	Facit 9325.3.6.
17. Multiply	259.2.	by 37. 2.	Facit 9632.4.4.
18. Multiply	314.7.5.	by 39. 1.3.	Facit 12312.0.6.3.3.

THE APPLICATION.

Artificer's work is computed by different measures, viz.

1. Glazing and mason's flatwork by the foot.
2. Painting, plaistering, paving, &c. by the yard.
3. Partitioning, flooring, roofing, tiling, &c. by the square of 100 feet.
4. Brickwork, &c. by the rod or 16 feet $\frac{1}{2}$, whose square is $172 \frac{1}{2}$.

MEASURING

MEASURING by the FOOT SQUARE, as GLAZIERS and MASONS Flatwork.

EXAMPLES.

19. There is a house with 3 tier of windows, 3 in a tier, the height of the first tier 8 feet 2 inches, the second 7 feet 3 inches, and the third 5 feet 8 inches, the breadth of each is 3 feet 10 inches, what will the glazing come to at 15d. per foot?

feet. in.			
8 . 2 the	242 . 5 . 6		
7 . 3 heights			
5 . 8 added	3 1/2 242	=	15.
	60 . 6 . . .	=	3d.
	4 1/2	=	4 in.
3 windows	3 1/2	=	1
	6 1/2	=	6 parts.
63 . 3 = 3 tier			
3 . 10 breadth	2 0)30 3	=	1 1/2

189 . 9 . . .	£15 . 3 . . 3/4 Ans.
52 . 8 . 6	

20. What is the worth of 10 squares of glass, each measuring 4 feet 9 inches long, and 2 feet 10 inches broad, at 4d. 3/4 per foot? *Ans.* £3 . 1 . 7 1/2.

21. There are 8 windows to be glazed, each measures 1 foot 6 inches wide, and 3 feet 2 inches in height, how much will they come to at 8d. 1/2 per foot? *Ans.* £1 . 6 . 1 1/2.

22. What is the price of a marble slab, whose length is 5 feet 10 inches, and the breadth 1 foot 11 inches, at 5s. 10d. per foot? *Ans.* £3 . 5 . 2 1/2.

MEASURING by the YARD SQUARE, as PAVIORS, PAINTERS, PLAISTERERS, and JOINERS.

NOTE. Divide the square feet by 9, and it will give the number of square yards.

EXAMPLES.

23. A room is to be ceiled, whose length is 75 feet 3 inches, and width 10 feet 6 inches, what will it come to at 3s. 5d. 1/2 per yard? *Ans.* £16 . 5 . 4

24. What will the paving a court-yard come to at $5d. \frac{1}{2}$ per yard, the length being 76 feet 4 inches, and breadth 53 feet 8 inches? *Ans.* £9..19..1 $\frac{1}{2}$.

25. A room painted 96 feet 7 inches about, and 11 feet 3 inches in height, what does it come to at $9d. \frac{1}{2}$ per yard? *Ans.* £4..15..6 $\frac{1}{2}$.

26. What is the content of a piece of wainscoting in yards square, that is 9 feet 4 inches long, and 7 feet 3 inches broad, and what will it come to at $5s. 8d. \frac{1}{2}$ per yard? *Ans.* £2..2..10.

27. What will the paving a court-yard come to, at $3s. 4d.$ per yard, if the length be 25 feet 9 inches, and the breadth 14 feet 8 inches? *Ans.* £7.

28. A person has paved a yard 45 feet 7 inches in front, and 76 feet 9 inches in length, and in this he laid a foot-way the depth of the yard, of 5 feet 9 inches in breadth; the foot-way is laid with Purbeck-stone at $3s. 8d.$ the yard, and the rest with pebbles at $2s. 6d.$ per yard, what will the whole come to? *Ans.* £51..8..11.

29. What will the plaistering a cieling come to, at $10d.$ the yard, supposing the length 23 feet 5 inches, and breadth 15 feet 9 inches? *Ans.* £1..12..6.

30. What will the wainscoting a room come to at $6s. 6d.$ per square yard, supposing the height of the room (taking in cornice and moulding) is 12 feet 4 inches, and the compass 87 feet 3 inches; the three window-shutters each 7 feet 6 inches by 3 feet 4 inches, and the door 7 feet by 3 feet 6 inches, the shutters and door being worked in both sides, is reckoned work and half work? *Ans.* £41..10..9 $\frac{1}{2}$.

MEASURING by the SQUARE of 100 Feet, in FLOORING, PARTITIONING, ROOFING, TYLING, &c.

EXAMPLES.

31. In 182 feet 7 inches in length, and 11 feet 9 inches in height, of partitioning, how many squares? *Ans.* 21 sq. 45 feet, 4 inches, 3 parts.

32. If a house 3 stories high, besides the ground floor, was to be floored at £6..10..- per square, and the house measured 21 feet 7 inches, by 16 feet 6 inches; there are 7 fire places, whose measures are two of 6 feet, by 4 feet 7 inches each, two of 6 feet, by 4 feet 4 inches each, and two of 5 feet 6 inches, by 4 feet 5 inches, and the seventh of 5 feet 3 inches, by 4 feet, and the well-hole for the stairs is 10 feet

10 feet 8 inches, by 8 feet 9 inches, what will the whole come to?

Ans. £56..17..6.

33. If a house measures within the walls 54 feet 8 inches in length, and 33 feet 4 inches in breadth, and the roof be of a true pitch, what will it come to roofing at 11s. 4d. per square?

Ans. £15..9..8.

NOTE. In tiling, roofing, and slating, it is customary to reckon the flat, and half of any building within the wall, to be the measure the roof of that building, when the roof is of a true pitch, i. e. when the rafters are $\frac{1}{2}$ of the breadth of the building; but if the roof is more or less than the true pitch, they measure from one side to the other, with a rod or string.

34. What will the tiling of a barn cost, at 25s. 6d. per square, the length being 45 feet 9 inches, and breadth 26 feet 4 inches on the flat, the eave boards projecting 15 inches on each side.

Ans. £24..9..11½.

MEASURING by the Rod.

NOTE. Bricklayers always value their work at the rate of a brick and a half thick; and if the thickness of the wall is more or less, it must be reduced to that thickness by this

RULE. Multiply the area of the wall by the number of half bricks the thickness of the wall is of; the product, divided by 3, gives the area.

EXAMPLES.

35. If the area of a wall be 5454 feet, and the thickness two bricks and a half thick, how many rods doth it contain?

Ans. 33 rods, 114 feet.

36. If a garden wall be 262 feet round, and 10 feet 9 inches high, and 3 bricks thick, how many rods doth it contain?

Ans. 20 rods, 193 feet.

37. How many square rods are there in a wall 72½ feet long, 15 feet 2 inches high, and 2½ brick thick?

Ans. 6 rods, 200 feet.

38. If the side walls of an house be 27 feet 6 inches in length, and the height of the roof from the ground 55 feet 9 inches, and the gable (or triangular part at top) to rise 4½ course of bricks (reckoning 4 course to a foot). Now 20 feet high is 1½ bricks thick, 20 feet more at 2 bricks thick, 15 feet 9 inches more at 1½ brick thick, and the gable at 1 brick thick; what will the whole work come to at £6..6.. per rod?

Ans. £50..8..11.

162 Duodecimals. The NEW TUTOR'S ASSISTANT.

Multiplying several figures by several, and the product to be produced in one line only.

RULE. The units multiply the common way,
Set down the units, carry tens away;
Then multiply the tens of upper line
By lower units, and to product join
The tens of lower line, when multiply'd
By upper units, and the tens beside
You had to carry, and then multiply
The hundreds that in upper line do lie
By lower units, to that product take
The sum that tens by tens do plainly make
With that sum too, that hundreds from below
By upper units multiply'd, will show.
And so proceed to work multiplicand
By every single figure that doth stand
In multiplier, as it comes to hand.

EXAMPLES.

Multiply -- 35234
by -- 52424

1847107216

140936

70468

140936

70468

126179

1847107216

EXPLANATION.

First, $4 \times 4 = 16$, that is, 6 and carry 1. Secondly, $3 \times 4 + 4 \times 2$, and 1 that is carried is 21, set down 1 and carry 2. Thirdly, $2 \times 4 + 3 \times 2 + 4 \times 4 + 2$ carried = 32; that is, 2 and carry 3. Fourthly, $5 \times 4 + 2 \times 2 + 3 \times 4 + 4 \times 2 + 3$ carried = 47; set down 7 and carry 4. Fifthly, $3 \times 4 + 5 \times 2 + 2 \times 4 + 3 \times 2 + 4 \times 5 + 4$ carried = 60; set down 0 and carry 6. Sixthly, $3 \times 2 + 5 \times 4 + 2 \times 2 + 3 \times 5 + 6$ carried = 51; set down 1 and carry 5. Seventhly, $3 \times 4 + 5 \times 2 + 2 \times 5 + 5$ carried = 37, that is, 7 and carry 3. Eighthly, $3 \times 2 + 5 \times 5 + 3$ carried = 34; set down 4 and carry 3. Lastly, $3 \times 5 + 3$ carried = 18, which, being multiplied by the last figure in the multiplier, set the whole down, and the work is finished.

THE

DEUTUTOR'S ASSISTANT.

PART V.

A Collection of Questions set down promiscuously, for the greater Trial of the foregoing RULES.

1. **W**RITTE down seven millions, six hundred and four thousand, five hundred and seven. *Ans.* 7664507.00
2. What is the value of 25 barrels of soap, at $5\frac{1}{2}$ per lb, each barrel weighing 250 lb. *Ans.* £148. 7. 64.
3. What will £575. amount to in $7\frac{1}{2}$ years, at 5 percent simple interest? *Ans.* £790. 12. 62.
4. At what rate percent will £575. amount to £790. in $7\frac{1}{2}$ years at simple interest? *Ans.* 5 per cent.
5. A piece of wainscot is 7 feet 3 inches long, and 2 feet 7 inches $\frac{1}{2}$ broad, what is the superficial content? *Ans.* 19 ft. 04. 6.
6. The less of two numbers is 159, their difference 25, the square of their product is required? *Ans.* 8569. 35. 36.
7. What is the decimal of 3 qrs. 21 lb. of an cwt.? *Ans.* .375.
8. What number, taken from the square of 63, will leave 22 times 45? *Ans.* 2079.
9. What number, added to the 3rd part of 3576, will make the sum 379? *Ans.* 267. 25.
10. What number, deducted from the 2nd part of 2262, will leave the 8th part of the same? *Ans.* 61.
11. A brigade of horse, consisting of 416 men, is to be formed into a square body, having 31 men in front, how many ranks will there be? *Ans.* 13 ranks.
12. If

164 *A Collection of Questions. The New Tutor's*

12. If a clerk's salary is £91.5. the year, what is that per day? *Ans. 5s.*

13. If $\frac{1}{4}$ of a ship is worth £5280. what is the worth of the whole? *Ans. £14080.*

14. D owes E £285.14. but he compounds for 6s. 6d. in the pound, what must E receive for his debt? *Ans. £92.17.1.*

15. How many dozen pair of stockings, at 15 groats a pair, can I buy for £170.5. *Ans. 56 doz. 9 pair.*

16. The spectator's club of fat people, though it consisted but of 15 persons, is said to weigh no less than 3 tons, how much, at an equality, was that per man? *Ans. 4 cwt.*

17. C owes D £576.15. but compounds with him for £144. what is that in the pound? *Ans. 4s. 11d.1.*

18. Four men have a sum of money to be divided amongst them in such manner, that the first shall have $\frac{1}{2}$ of it, the second $\frac{1}{3}$, the third $\frac{1}{4}$, and the fourth the remainder, which is 28, what is the sum? *Ans. £112.*

19. A room, 36 feet long, and 18 feet wide, is to be covered with painted cloth, how many yards of $\frac{1}{2}$ wide will cover it? *Ans. 96 yards.*

20. There are two numbers, the one 96, the other twice as much, what is the difference between their sum and difference? *Ans. 192.*

21. There are two numbers, the one 35, the other the square of 35, I demand the square root of the sum of their squares. *Ans. 125.5 nearly.*

22. A stone that measures 5 feet 9 inches long, 3 feet 7 inches broad, and 2 feet 5 inches deep, how many solid feet doth it contain? *Ans. 49 feet, 9.63.*

23. If I have an estate of £550. per annum, what may I expend daily, and yet lay up £150. per annum? *Ans. £1.11.14.*

24. What is the value of 25 doz. 7 lb. of candles, at 7d. per lb. *Ans. £8.19.11.*

25. What principal sum did £50. interest arise from in one year, at the rate of 5 per cent. per annum? *Ans. £1000.*

26. Having bought 60 yards of cloth, at 7s. 6d. per yard, and 50 yards, at 11s. 9d. per yard, what is the value of both pieces? *Ans. £51.17.6.*

27. In 684 Spanish guilders, of 30s. each, how many French pistoles, at 17s. 6d. per piece? *Ans. 197 $\frac{1}{2}$.*

28. In

28. In seven cheeses, each weighing 1 cwt. 2 qrs. 7 lb. how many allowances for seamen may be cut, each weighing 4 oz. 9 dr.?

Ans. 4983 $\frac{1}{2}$.

29. If 36 taken from 130 leaves 94, and 65 taken from 94 leaves 29, and 9 taken from thence leaves 20, what number is that, out of which, when you have taken 36, 65, and 9, leave 20?

Ans. 139.

30. What is the value of 18 barrels of soap, at $5d. \frac{1}{2}$ per lb. each barrel containing 237 lb.?

Ans. £93. 3. 10.

31. If £100. principal gain £5. interest in 12 months, what principal will gain £30. in 8 months?

Ans. £900.

32. How many yards of cloth, at $15s. 3d.$ per yard, can I have for 10 cwt. 3 qrs. 7 lb. of wool at $15d.$ per lb.?

Ans. 99 $\frac{1}{2}$.

33. If I buy 1000 ells of Flemish linen for £100, what may I sell it at per ell in London, to gain £12. by the whole?

Ans. 3s. 8d. $\frac{1}{2}$.

34. An oilman bought 375 cwt. 3 qrs. 17 lb. gross weight of train oil, tare 20 lb. per 112 lb. how many neat gallons were there, allowing $7 \frac{1}{2}$ lb. to a gallon?

Ans. 4601 $\frac{1}{2}$ nearly.

35. What number, taken from the square of 72, will leave 10 times 54?

Ans. 4138.

36. If $\frac{1}{2}$ of an ounce cost $\frac{1}{2}$ of a shilling, what will $\frac{1}{2}$ of a lb. cost?

Ans. 17s. 6d.

37. If the salary of an officer be 56s. per annum, what must he receive for 273 days?

Ans. £42. 5. 12.

38. A gentleman spends one day with another £116. 4s. and at the year's end layeth up £350. what is his yearly income?

Ans. £831. 6. 10 $\frac{1}{2}$.

39. What number is that, to which if you add $7 \frac{1}{2}$, the whole will be $12 \frac{1}{2}$?

Ans. 4 $\frac{1}{2}$.

40. If for £11. 6s. I have 1250 lb. carried 54 miles, how many lb. can I have carried 36 miles for the same money?

Ans. 1875.

41. What number is that which, being multiplied by $\frac{1}{2}$ will produce $\frac{1}{2}$?

Ans. 1.

42. A man dies, and leaves £240. to be given to three persons, viz. D, E, F, to D a share unknown, to E twice as much as D, and F as much as D and E, what was the share of each?

Ans. D £40. E £80. and F £120.

43. There

166. *A Collection of Questions. The New Tutor's*

43. There is a sum of £1500. to be divided among 3 men in such manner, that if A has £3. B shall have £5. and C £8. how much must each man have?

Ans. A 281, 5. B 468, 15. C 750.

44. A merchant at Amsterdam is indebted to another in London £756. and would pay it in Spanish guilders at 30d. each, how many must the English merchant receive?

Ans. 6048.

45. What number added to $12\frac{3}{4}$ will produce $18\frac{1}{2}$?

Ans. $5\frac{3}{4}$.

46. What is the value of 154 hogheads of tobacco, each weighing 12 cwt. at £2..6..3. per cwt.?

Ans. £4273..10..--

47. A snail in getting up a may-pole only 20 feet high, was observed to climb 8 feet every day, but every night he came down 4 feet; in what time by this method did he reach the top of the pole?

Ans. 4 days.

48. If the $\frac{1}{2}$ of 6 be 3, what will the $\frac{1}{2}$ of 20 be?

Ans. 7 $\frac{1}{2}$.

49. If I buy yarn for 10d. the pound, and sell it again for 15d. what do I gain per cent.?

Ans. £50.

50. What is the value of 18 barrells of soap, at 5s. $\frac{1}{2}$ per lb. each barrel containing 256 lb.?

Ans. £115..12..--

51. Two persons, A and B, owe several debts; the less debt being that of A is £35 27. the difference is £25 6. what is the debt of B?

Ans. £3783. B.

52. What sum is that which being added to £279..15..-- makes it to be £594..7..6.?

Ans. £314..12..6.

53. If when wheat is 4s. the bushel the 20 penny loaf weighs 18 lb. what must the said 20 penny loaf weigh, when wheat is 6s. the bushel?

Ans. 12 lb.

54. A gentleman went to sea at 19 years of age; 18 years after that he had a son born, who lived 46 years, and died before his father; after whom the father lived twice 20 years, and then died also; what was the age of the father when he died?

Ans. 123.

55. The sum of two numbers is 284, the less 94, what is their difference, product, and larger quote?

Ans. 90 diff. 17860 prod. 277 quote.

56. C hath an estate of £68. per annum, and payeth 7s. 6d. subsidy, what must D pay, whose estate is worth £136. per annum?

Ans. 15s.

57. What

57. What is the value of $\frac{3}{4}$ of 20s.? *Ans.* 12s.
58. My purse and money, quoth Tom, are worth 36s. 8d. but the money is worth 7 of the purse, what was the sum therein? *Ans.* £1s. 12s. 1.
59. A maltster has several sorts of malt, one at 4s. another at 3s. 9d. and a third at 3s. 3d. what must be the price of a bushel? *Ans.* 3s. 8d.
60. Bought a cask of wine for £74. 16s. how many gallons were in the same, when a gallon was valued at 5s. 6d.? *Ans.* 272.
61. How many dollars, at 4s. 2d. each, must be given for 380 guilders, at 2s. 1d. each? *Ans.* 190.
62. What is the amount of £1500. for 5 years and a half, at 4 $\frac{1}{2}$ per cent. simple interest? *Ans.* £1891. 17. 6.
63. A, B, and C, trading together, gained £180. which is to be shared according to each man's stock; A put in £70. B £150. and C £80. what is each man's share? *Ans.* A 42. B 90. C 48.
64. There are three numbers, 18, 22, and 38, I demand the difference between the sum of the squares of the first and last, and cube of the middlemost? *Ans.* 8880.
65. What does the whole pay of a man of war's crew of 650 sailors amount to for 35 months service, at 22s. 6d. per month? *Ans.* £25593. 15s.
66. What number is that which being divided by 25, the quotient will be 76? *Ans.* 1900.
67. Bought 35 qrs. 3 bush. of wheat, at 5s. 6d. per bushel, what do they come to? *Ans.* £77. 16. 6.
68. How many pounds of coffee, at 5s. 10d. per lb. are equal in value to 525 lb. of tea, at 12s. 7d.? *Ans.* 1132 $\frac{1}{2}$ lb.
69. A traveller would change 450 French crowns, at 4s. 6d. per crown, into sterling money, but he must pay a halfpenny per crown for change: how much must he receive? *Ans.* £100. 7. 13.
70. A father, ignorant in numbers, ordered £400. to be divided among his 5 sons, thus: give A $\frac{1}{2}$ B $\frac{1}{3}$ C $\frac{1}{4}$ D $\frac{1}{5}$ and E $\frac{1}{6}$ part; divide this equitably among them, according to the father's intentions? *Ans.* A £122. 1. B £91. 10. C £73. 4. D £61. E £52. 5. 11.
71. What

1668 A Collection of Questions. The New Tutor's

71. What number is that from which if the square of 13 be deducted, and the square of 12 be added, the sum will be 250? *Ans.* 223.
72. A and B trade together, A put £270 for 4 months, B £360 for 3 months, they gain £100. what must each man receive? *Ans.* £50. each.
73. What number, added to the cube of 25, will make the sum equal to 114 times 150? *Ans.* 2159.
74. Bought threescore pieces of Holland for three times as many pounds, and sold them again for four times as much; but if they had cost me as much as I have sold them for, what should I have sold them for to gain after the same rate? *Ans.* £320.
75. If I buy a yard of cloth for 15s. 6d. and sell it for 17s. 9d. what do I gain per cent.? *Ans.* £12..13..6.
76. If $\frac{3}{4}$ of a gallon cost $\frac{1}{4}$ of £1. what will $\frac{1}{2}$ of a tun cost? *Ans.* £105.
77. A lady's fortune consisted of a cabinet worth £300. containing 18 drawers, each having 2 partitions, each of which contained 35 guineas and 2 crowns. pray what was her portion? *Ans.* £1641.
78. A captain and 150 sailors took a prize worth £1500. the captain had $\frac{1}{5}$ for his share, and the rest was equally divided among the sailors, what was each man's part? *Ans.* £8. each.
79. If 10 canons in one day spend 55 barrells of powder, demand how many barrells 36 canon will spend in 21 days? *Ans.* 4158.
80. If 340 men in garrison, and have provision for 6 months, but hearing of no relief at the end of 5 months, how many men must depart, that the provisions may last so much longer? *Ans.* 272 to depart.
81. What number, multiplied by $\frac{1}{2}$, will produce 11 $\frac{1}{2}$? *Ans.* 26 $\frac{1}{2}$.
82. My factor sends me word he has bought goods to the value of £575..12..6. on my account, what will his commission come to at 2 $\frac{1}{2}$ per cent.? *Ans.* £14..7..9 $\frac{1}{2}$.
83. What is the difference between 15452 and the fourth of itself? *Ans.* 11589.
84. How

84. How many lb. of sugar, at $5d. \frac{1}{2}$ per lb. must be given in barter for 70 gross of incle, at $7s. 10d.$ per gross?

Ans. 1253 $\frac{1}{2}$.

85. A tobacconist would mix 30 lb. of tobacco at $10d.$ per pound, with 90 lb. at $12d.$ per lb. 60 lb. at $18d.$ per lb. with 18 lb. at $2s.$ per lb. what will a pound of this mixture be worth?

Ans. $14d. \frac{1}{2} \frac{1}{3}$.

86. What is the difference between twice five and forty and twice forty-five, and between twice seven and twenty and twice twenty-seven?

Ans. 40 and 20.

87. A schoolmaster being asked how many scholars he had, said, If I had as many more, half as many, and 1 quarter as many, I should have 99; how many had he?

Ans. 36.

88. From £100. borrowed, take 72 paid,

'Twas a virgin that lent it, what's due to the maid?

Ans. £28.

89. A hath candles at $6s. 8d.$ per dozen ready money, but in barter will have $7s.$ per dozen; B hath cotton at $10d.$ per lb. ready money. I demand what price the cotton must be at in barter; also how much cotton must be bartered for 100 dozen of candles?

Ans. $10d. \frac{1}{2}$ per lb. 7 cwt. 16 lb.

90. There are two numbers, the one 72, and the other half as much, I demand the product of their square, and the difference of their product and sum?

Ans. 6718464 product of sq. 2484 diff.

91. A has 752 yards of cloth, at $15s.$ per yard, ready money, but in barter will have $17s.$ B has wine at £45. per tun, ready money. The question is, how much wine must be given for the cloth, and what must be the price of a tun of wine in barter?

Ans. £51. per tun. 22 tun, 29 gall. 2 quarts.

92. Bought 35 bags of ginger, each weighing gross 96 lb. $\frac{3}{4}$, tare 1 lb. $\frac{3}{4}$ per bag, tret 4 lb. per 104 lb. what do they come to at $8d. \frac{3}{4}$ per lb.?

Ans. £110. -- 11 $\frac{1}{2}$.

93. A young man received £274. which was $\frac{3}{4}$ of his eldest brother's portion; now three times the eldest brother's portion was half the father's estate, what was the father's estate?

Ans. 2466.

94. A has 12 fother of lead to send abroad, each being $19 \frac{1}{2}$ times 112 lb. B has 40 casks of tin, each 370 lb. how

Q

many

170 *A Collection of Questions. The New Tutor's*

many ounces difference is there in the weight of these two commodities? *Ans.* 182½ 28 oz.

95. An usurer put out £85. for 12 months, and received for principal and interest £93. 10. 4. required the rate per cent. he received interest at? *Ans.* 10 per cent.

96. B has 27 cows worth 87s. each, and C 9 horses worth £12. apiece; how much will make good the difference, in case they interchange the said drove of cattle? *Ans.* £9. 9. 0.

97. A person dying, left his widow £2500. and £1140. to each of his four children; he had been 27½ years in trade, and had cleared on an average £157. per annum, what had he to begin trade with? *Ans.* £2742. 10. 0.

98. A butcher lends his man with 300 guineas to a fair to buy cattle, oxen at £12. cows at £3. colts at £1. 10. 0. and hogs at £1. 17. 0. per piece, and of each sort a like number, how many of each did he buy? *Ans.* 18 of each sort, and £2. 14. 0. over.

99. A man had 12 sons, the youngest was 3 years old, and the eldest 58; they increased in arithmetical progression, what was the common difference of their ages? *Ans.* 5.

100. Miss Kitty told her sister Clara, whose father had before left them £12000. apiece, that their grandmother by will had raised her fortune to £15400. and had made her own £20000. what did the old lady leave them? *Ans.* £11400.

101. There is in 3 bags the sum of £2547. viz. in the first bag £1525. in the second £276. what was in the third bag? *Ans.* £746.

102. An ancient lady being asked how old she was, to avoid a direct answer, said, I have 9 children, and there are 3 years between the birth of each of them; the eldest was born when I was 19 years old, which is now exactly the age of the youngest; how old was the lady? *Ans.* 62.

103. Whereas a noble and a mark just 15 yards did buy; How many ells of the same cloth for £50. had I. *Ans.* 600.

104. A broker bought for his principal, in the year 1720, £500. capital stock in the South Sea, at £850. per cent. and sold it again when it was worth but £150. per cent. how much was lost on the whole? *Ans.* £3500.

105. If I buy 200 yards of ribband, at 3 yards for a shilling, and 200 more, at 2 yards for a shilling, and sell them at the rate of 5 yards for 2s. whether do I get or lose, and how much?

Ans. 6s. 8d. lost.

106. What number is that which make 12 to be the $\frac{1}{4}$ of it?

Ans. 16.

107. A farmer is willing to make a mixture of rye at 5s. the bushel, barley at 4s. the bushel, and oats at 3s. the bushel, how much must he take of each to sell it at 3s. 6d. the bushel?

Ans. 6 barley, 6 rye, 24 oats.

108. A person said he had 20 children, and that it happened there was a year and half between each of their ages; his eldest son was born when he was 24 years old, and the age of the youngest is 21; what was the father's age?

Ans. 73 $\frac{1}{2}$.

109. A sheepfold was robbed 3 nights successively; the first night half the sheep were stolen, and half a sheep more; the second night half the remainder were lost, and half a sheep more; the last night they took half what were left, and half a sheep more; by which time they were reduced to 20; how many were they at first?

Ans. 167.

110. A merry young fellow in a small time got the better of $\frac{1}{2}$ of his fortune; by advice of his friends he gave £2200. for an exempt's place in the guards; his profusion continued till he had no more than 880 guineas left, which he found by computation was $\frac{1}{6}$ of his money, after the commission was bought; pray what was his fortune at first?

Ans. 16450.

111. Charlotte told her brother Sam, that though her fortune on her marriage took £21514. out of her family, it was but $\frac{1}{3}$ of two years-rent of his yearly income; pray what was that?

Ans. £17928..6..8.

112. Says A to B if I had four of your sheep I should have as many as you; and says B to A, if I had four of yours I should have twice as many as you; how many had each?

Ans. A 20. B 28.

113. A gentleman having 50s. to pay among his labourers for a day's work, would give to every boy 6d. to every woman 8d. and to every man 16d. the number of boys, women, and men, were the same. I demand the number of each?

Ans. 20.

114. D

172 *A Collection of Questions.*

114. D and E traded together, and gained £100. D put in £650. E put in so much that he received £60. of the gain. I demand how much E put in? *Ans. £975.*

115. Two men depart both from one place, the one goes North, the other South; the one goes 9 miles a day, the other 14 miles a day; how far are they distant the 12th day of their departure? *Ans. 276 miles.*

116. A jeweller sold jewels to the amount of £1500. for which he received in part 900 French pistoles, at 17s. 6d. each, what sum remains unpaid? *Ans. £712. 10. -.*

117. When first the marriage knot was ty'd,
Between my wife and me,
Her age did mine as far exceed,
As three times three does three:
But when seven years, and half seven years,
We man and wife had been,
My age came then as near to hers,
As eight is to sixteen.

Quest. What was each of our ages when we married?

Ans. 10½ man, 31½ woman.

118. If 12 oxen will eat 3½ acres of grass in four weeks, and 21 oxen will eat 10 acres in 9 weeks, how many oxen will eat 24 acres in 18 weeks, the grass being allowed to grow uniformly? *Ans. 36.*

119. A lady was asked her age, who replied thus:
My age if multiplied by three,
Two sevenths of that product tripled be,
The square root of two-ninths of that is four,
Now tell my age, or never see me more.

Ans. 28.

120. What number is that, from which if you take $\frac{2}{3}$, the remainder will be $\frac{1}{4}$? *Ans. $\frac{28}{3}$.*

121. Sold goods, amounting to the value of £800. for two 4 months, what is the present worth, at 5 per cent. simple interest? *Ans. £780. 10. 9½.*

A TABLE for finding the INTEREST of any sum of money for any number of months, weeks, or days, at any rate per cent.

Year.	Calen. Mon.			Weeks.			Day.		
£.	£.	s.	d.	£.	s.	d.	£.	s.	d.
1	..	..	11.8	..	..	4½	..	..	½
2	..	..	3.4	..	..	9½	..	..	1½
3	..	..	5.8	..	1..	1½	..	..	2
4	..	..	6.8	..	1..	6½	..	..	2½
5	..	..	8.4	..	1..	11	..	..	3¼
6	..	..	10.8	..	2..	3½	..	..	4
7	..	..	11.8	..	2..	8½	..	..	4½
8	..	..	13.4	..	3..	1	..	..	5¼
9	..	..	15.2	..	3..	5½	..	..	6
10	..	..	16.8	..	3..	10½	..	..	6½
20	..	1..	13.4	..	7..	8½	..	1..	1½
30	..	2..	10.8	..	11..	6½	..	1..	7¼
40	..	3..	6.8	..	15..	4½	..	2..	2¼
50	..	4..	3.4	..	19..	2½	..	2..	9
60	..	5..	—	..	1..	3.. 1	..	3..	3½
70	..	5..	16.8	..	1..	6.. 11	..	3..	10
80	..	6..	13.4	..	1..	10.. 9½	..	4..	4½
90	..	7..	10.8	..	1..	14.. 7½	..	4..	11¼
100	..	8..	6.8	..	1..	18.. 5½	..	5..	5½
200	..	16..	13.4	..	3..	16.. 11	..	10..	11½
300	..	25..	—	..	5..	15.. 4½	..	16..	5½
400	..	33..	6.8	..	7..	13.. 10	1..	1..	11
500	..	41..	13.4	..	9..	12.. 3½	1..	7..	4¾
600	..	50..	—	..	11..	10.. 9	1..	12..	10½
700	..	58..	6.8	..	13..	9.. 2½	1..	18..	4¼
800	..	66..	13.4	..	15..	7.. 8½	2..	3..	10
900	..	75..	—	..	17..	6.. 1½	2..	9..	3¾
1000	..	83..	6.8	..	19..	4.. 7½	2..	14..	9½
2000	..	166..	13.4	..	38..	9.. 2½	5..	9..	7
3000	..	250..	—	..	57..	13.. 10	8..	4..	4½
4000	..	333..	6.8	..	76..	18.. 5½	10..	19..	2
5000	..	416..	13.4	..	96..	3.. —¾	13..	13..	11½
6000	..	500..	—	..	115..	7.. 8½	16..	8..	9
7000	..	583..	6.8	..	134..	12.. 3½	19..	3..	6½
8000	..	666..	13.4	..	153..	16.. 11	21..	18..	4¼
9000	..	750..	—	..	173..	1.. 6½	24..	13..	1½
10,000	..	833..	6.8	..	192..	6.. 1½	27..	7..	11¼
20,000	..	1666..	13.4	..	384..	12.. 3½	54..	15..	10½
30,000	..	2500..	—	..	576..	18.. 5½	82..	3..	10

RULE. First let the principal be multiply'd
By rate, and months, or weeks, or days beside;
From product take two figures at right hand,
From table take the different sums that stand
Against such numbers, as together make
Last product, and their sum for answer take.

NOTE. But to that sum two-pence must added be
 For ev'ry ten cut off, when months you see,
 But if from weeks you find the answer come,
 For ev'ry ten take but one-fourth that sum.
 If days, for forty, but one farthing take,
 Which, with the rest, will the true answer make.

EXAMPLES.

1. What is the interest of £2467..10.. for 10 months, at 4 per cent. per annum?

$\begin{array}{r} 2467..10 \\ \hline 9870.. \\ \hline 10 \text{ months.} \end{array}$	$\begin{array}{r} 900 = 75.. \\ 80 = 6..13..4 \\ 7 = 1..11..8 \\ \hline 987 = 82..5.. \end{array}$
---	--

987|00

2. What is the interest of £2467..10.. for 12 weeks, at 5 per cent.?

$\begin{array}{r} 2467..10 \\ \hline 12387..10 \\ \hline 12 \text{ weeks.} \end{array}$	$\begin{array}{r} 1000 = 19..4..7\frac{1}{2} \\ 400 = 7..13..10 \\ 80 = 1..10..9\frac{1}{2} \\ 50 = 1..10..2\frac{1}{2} \\ \hline 1480 50 = 28..9..5 \end{array}$
---	---

1480|50..0

3. What is the interest of £2467..10.. for 50 days, at 6 per cent.?

$\begin{array}{r} 2467..10 \\ \hline 14805.. \\ \hline 50 \text{ days.} \end{array}$	$\begin{array}{r} 7000 = 19..3..6\frac{1}{2} \\ 400 = 1..1..11 \\ 2 = 1..1..1\frac{1}{2} \\ 50 = 1..1..1\frac{1}{2} \\ \hline 7402 50 = 20..5..7 \end{array}$
--	---

7402|50

To find what any estate, from 1 to £60,000. per annum, will come to for one day.

RULE. Collect the rent from table for a year,
 And add the sums that opposite appear,
 In line for days, 'twill give the answer clear.
 An estate of £376. per annum, what is that per day?

$$\begin{array}{r} 300 = 16..5\frac{1}{2} \\ 70 = 3..10 \\ 6 = 4 \\ \hline \end{array}$$

$$376 = 1..7\frac{1}{2}$$

To find the amount of any income, salary, or servant's wages, for any number of months, weeks, or days.

RULE. The given yearly rent first multiply
By months, weeks, days, that in the question be
From table take the products that you see
Lie opposite, they will the answer be.

What will £270. per annum come to for 11 months, for 3 weeks, and for 6 days.

For 11 months.

For 3 weeks.

$$\begin{array}{r} 270 \\ 11 \text{ months.} \\ \hline 2970 \\ 2970 = 247..10..- \end{array}$$

$$\begin{array}{r} 270 \\ 3 \\ \hline 810 \\ 810 = 15..11..7 \end{array}$$

For 6 days.

For the whole time.

$$\begin{array}{r} 270 \\ 6 \\ \hline 1620 \\ 1620 = 4..8..9\frac{1}{2} \end{array}$$

$$\begin{array}{r} 247..10..- \\ 15..11..7 \\ 4..8..9\frac{1}{2} \\ \hline 267..10..4\frac{1}{2} \end{array}$$

A TABLE, shewing the number of days from any day in the month, to the same day in any other month throughout the year.

To	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
From Jan.	365	31	59	90	120	151	181	212	243	273	304	334
Feb.	334	365	28	59	89	120	150	181	212	242	273	303
Mar.	306	337	365	31	61	92	122	153	184	214	245	275
Apr.	275	306	334	365	30	61	91	122	153	183	214	244
May	245	276	304	335	365	31	61	92	123	153	184	218
June	214	245	273	304	334	365	30	61	91	122	153	183
July	184	215	243	274	304	335	365	31	62	92	123	153
Aug.	153	184	212	243	273	304	334	365	31	61	92	122
Sept.	122	153	181	212	242	273	303	334	365	30	61	91
Oct.	92	123	151	182	212	243	273	304	335	365	31	61
Nov.	61	92	120	151	181	212	242	273	304	334	365	30
Dec.	31	62	90	121	151	182	212	243	274	304	335	365

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